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- Rev Monitor
- Sinclair Programmable, Linn-Sondek reviewed
- Burglar Alarm
- NEC CQ110E Ham Rig

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Today's standards in hi fi insist on components with the highest standards of performance. JVC's speaker range is not only designed to give you this faultless reproduction, but is designed to be extremely durable as well. Years of research have ensured that all JVC speakers — whether they be omni-directional, bass reflex — together with the different types of speaker used, meet the most discriminating needs. The special materials selected in the construction of the domes, for instance, is the very finest available, and no expense has been spared at any stage of manufacture. Extensive research into sound and sound projection has also proved itself worldwide — in competition with many other brands of less critical construction. JVC — you can hear clearly now.

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A MODERN MAGAZINES PUBLICATION

JULY 1977, Vol. 7. No. 7

Editorial — Les Bell
Publisher — Collyn Rivers

NEXT MONTH IN ETI

741 COOKBOOK

PROJECTS

FEATURES

NEWS & INFORMATION

IMPORTANT NOTICE

In view of the recent legalisation of CB radio, we have decided to postpone the SSB CB rig offer announced last month until a model becomes available which meets the full Australian specs.

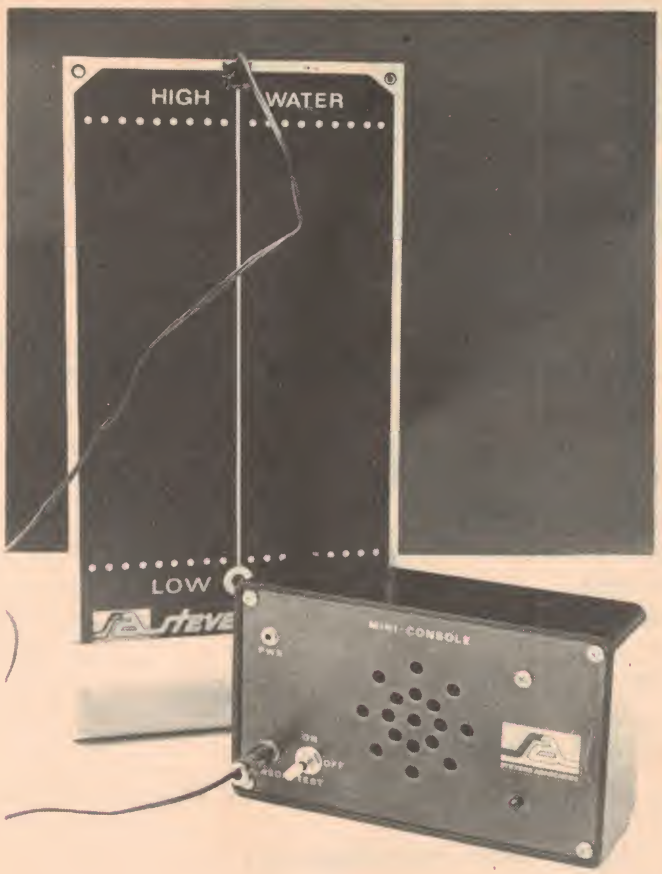
Free Inside... CB Australia covers the new licences.

Cover: The good old days and the good new days of electronics.

*Recommended retail price only

News Digest

Pool Alarm



Many children drown each year in home swimming pools. And whilst local councils generally specifiy that home pools must be protected by a substantial fence, such fences often do little more than present a challenge for a toddler to surmount.

Hence the recent proliferation of alarms which purport to warn of children slipping or tumbling into a pool.

Such alarms are harder to design than might at first appear because they must discriminate between a true alarm situation and false indications caused by other physical transients such as wind-induced ripples, loud noises, local electrical disturbances, etc.

Most currently available alarms monitor wave patterns, usually via a floating sensor consisting of three or more 'fixed' floats and one able to move vertically relative to the fixed floats. Other systems monitor 'noise' via a submerged hydrophone whilst yet others monitor wave patterns relative to the pool side. We have tested most of these devices and while some work much better than others, none is wholly satisfactory.

Because of this prior involvement, we were most interested to see a pool alarm system manufactured by the US company Stevens Associates – imported into Australia by Rudi Hoess of *Electronic Concepts, 52-58 Clarence Street, Sydney 2000.*

This is a most elegant design. The sensor consists of a double sided 'PC board' which in effect is a capacitor, the value of which depends upon the depth by which it is submerged in water. Thus any ripple on the surface will be translated by the sensor into a corresponding capacitance change. This change is then evaluated by the monitoring unit which rejects signals uncharacteristic of those caused by a toddler slipping or falling into a pool.

A shaped section on the lower edge of the transducer also assists in pattern recognition. It's simple, it's elegant – and it works. It's also quite costly compared to many others. But how much do you value the safety of *your* kids – or your friends' and neighbours'?

HP Watch

Hewlett-Packard have announced the release of their long-awaited 'Project Cricket', the HP 01. This is a combined wristwatch and calculator based on improved versions of their existing calculator chips. The 6 oz. watch contains two calculator chips, a watch chip and new memory chips providing around 40 computing and timing functions. At somewhere between $650 and$750 in the States, the watch will be sold as a piece of technocratic jewellery, a status symbol for the fashion-conscious engineer.

3½ Digit DMM

Now available from Dick Smith Electronics is the Sinclair DM2 3½ digit multimeter. The DM2 features: MOS/LSI circuitry, DC voltage measurement from 1 to 1000 volts, AC from 1 to 500V, both AC and DC current from 1 mA to 1 A and four resistance ranges. It is ruggedly constructed and can be used with internal batteries or external AC adapter. Dick's price is $145.00.

Consumer Electronics Show 1977

If you are even remotely near Sydney in early August do make sure you visit the '77 Consumer Electronics Show at the Sydney Hilton.

This year's show is twice the size of last year's effort – and that was impressive enough!

Electronics Today International together with our sister publication Hi-Fi Review will once again have a room there – and if all goes according to plan we will have some very impressive bits of electronics indeed!

If you're visiting the show, do call in to see us. This is basically your magazine so here's a good opportunity to tell us what you'd like to see in it.

The show is open to the public on the following days: Thursday, August 4th, from 6p.m. to 10p.m., Friday August 5th, from 10a.m. to 10p.m., and Saturday August 6th, from 10a.m. to 6p.m. Details of Trade-only days will be found in our 'Sound' section in this issue.

Lux Lab Series

The Lux Corporation of Japan has released a new Laboratory Reference Series designed for professional and audio purist use, featuring DC circuitry using Lux-developed FETs which are claimed to eliminate the temperature drift problems which have plagued earlier attempts at DC amps.

The LR series consists of several units designed to complement each other in various configurations according to the needs of the user. Each unit is designed to do a specific job and that job only, so that the user can decide on the various functions required for his purposes and build a 'stack' of units accordingly. The units in the series all have recesses on the top in which the legs of the other modules can be fitted to build the stack without the use of a special rack.

At this stage, the LR series comprises a DC power amplifier, a basic DC real-time-processed (?) pre-amp, frequency-synthesized digital read-out FM tuner, tone control centre, graphic equalizer, LED peak indicator and an integrated amplifier.

One of the design criteria was the elimination of control duplication which occurs with conventional units when they are combined. As a result the pre-amp is fitted with no tone controls except for the patentes Lux linear equalizer to compensate for deficiencies in recordings and room acoustics. But it can be used with either the Stereo Control Centre or the graphic equalizer, depending on the amount of tone contouring required by the individual user.

The tone control unit incorporates a subsonic 'T' filter with two cut-off points and a separate fine-tuning control, providing a selectably broad or narrow null. The visible reduction in cone movement lessens doppler distortion in the speaker and prevents amplifier power wastage.

The frequency-synthesized FM tuner incorporates two displays, both digital and analogue, plus seven station memory and built-in Dolby circuitry.

About that Offer

Our recent projects and articles about biofeedback techniques have aroused even greater interest than we anticipated.

Because of this we were fascinated to learn that Unitrex Pty Ltd. were planning to sell a blood-pressure monitoring kit for home use. Apparently these kits have been marketed in the USA for some time – and are being bought in large numbers.

Unitrex do of course stress that the kits are not in any way a biofeedback device – but for those concerned about blood-pressure (which must realistically mean almost anyone over 35 or so!) then they're an intriguing purchase.

We've seen the kits and they really are professional devices. Interested – then see page 41.

THE ADC CARTRIDGE CAUSES NO PERCEIVABLE WEAR OVER THE LIFE OF A RECORD.

A series of tests conducted by a leading independent audio-testing laboratory prove it.*

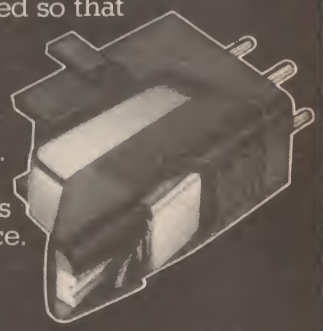
The tests show that the ADC XLM-MKII cartridge causes no perceivable wear until after 60 plays. Industry sources estimate the "life of a record" (the average number of times a record is played) to be 40 to 50 plays.

Other cartridge manufacturers may talk about less record wear, but ADC has proven *no wear over the average life of a record.*

The reason for this is our unique patented design. It's patent #3294405.

We call it the "induced magnet" cartridge.

Most cartridges are designed so that a heavy magnet is part of the moving system.



The ADC XLM-MKII is different, because our engineers found a way to detach the magnet and reposition it above the stylus, so the stylus applies less pressure against the groove.

Less pressure means less wear.

The fact is, of all the leading brands, ADC cartridges have the lowest mass moving system you can buy. That means better sound and superior performance.

The XLM frequency response is exceptionally flat, from 15Hz to 24KHz ±1.5dB. And for the ultimate in stereo reproduction, it has a minimum of 28dB of channel separation.

Think about it. In the long run you'll probably spend more on your record collection than you will on your whole stereo system. So it makes sense to buy a cartridge with proof that it makes your records sound better and helps them to live longer. The ADC low mass cartridge.

Unbelievable.

THE ADC LOW MASS CARTRIDGE.

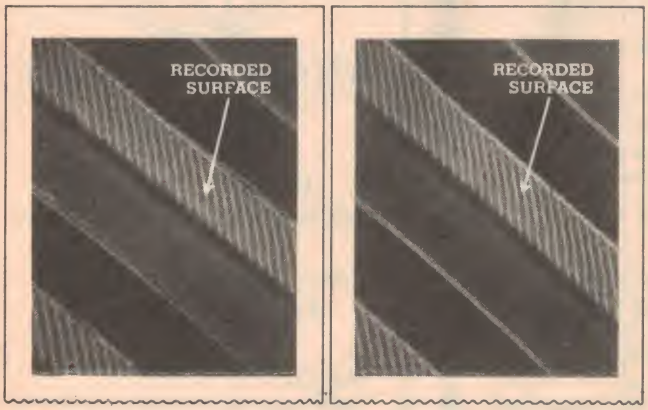
IT HELPS YOUR RECORDS LIVE LONGER.

ADC

A BSR COMPANY

BSR (A'asia) Pty. Ltd.,
Anne Street, St. Mary's, NSW 2760.

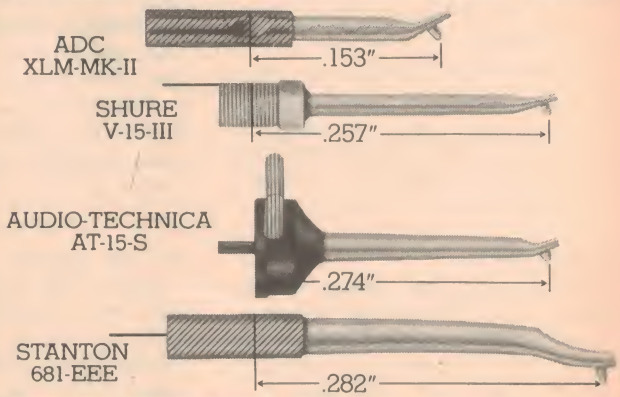
THE PROOF:



This is a photomicrograph of a 20kHz record groove that has never been played before.

This is a photomicrograph of a similar 20kHz record groove played 75 times with an ADC XLM-MKII cartridge. As you can see there is no difference.

THE DIFFERENCE:



The way to get the most accurate reproduction of sound is to lower the total effective mass of the moving parts of the stylus. And that's exactly what our engineers did. In fact, of all the leading brands, ADC cartridges have the lowest mass moving system you can buy.

INDUCED MAGNET

MAGNET

* CBS Technology Center Project 1108: Record Wear Test Program. Performed for Audio Dynamics Corporation. December 1976.

COMPTON BSR137

Logic State Analyser

The new Model 1610A keyboard-controlled Logic State Analyser from Hewlett-Packard is a powerful, general purpose analyser for design and trouble-shooting of digital systems – from the most elementary to the most complex. With the easy-to-operate 1610A keyboard, the user can trace events in as many as 32 channels at rates of up to 10 MHz, selecting only the particular occurrences, coincidences or logical sequences that are of interest, with results displayed in a well organised format on the CRT screen. A memory 32 bits wide and 64 bits deep can be commanded to capture everything that went on for 63 clock periods after the trace point of interest, or for 63 periods before; or the trace point may be selected to be in the centre of a trace. Not only can the instrument trace and display logic states, it can also measure absolute or relative time intervals between events, it can count events, it has a graph mode for an overview of all 64 words in memory, and it can be connected to a printer to produce documentation.

One of the most important features of the 1610A is its power to locate trace positions. The analyser races through the test data at 10 MHz in search of the desired trace point and finds that exact location through a series of sequential state conditions set by the operator. From one to seven state conditions, each of which must be encountered by the analyser in the form and order specified, may be entered into the machine to assure that the analyser will indeed capture the desired data – not similar data.

The new logic state analyser has nine edit keys, of which four control cursor movement. DELETE/INSERT keys are used in the trace specification menu to enter or remove states within the trace sweep. A default key returns a displayed menu to a known condition. Two graph control keys, INCREMENT and DECREMENT, automatically change upper and lower graph limits. The machine will self-test 99% of its functions.

The Model 1610A, with four data probes, one clock probe, and operating and service manuals, is priced at $10690 duty-free. *Hewlett-Packard Australia Pty. Ltd., 31-41 Joseph St., Blackburn, Victoria 3130.*

KENT HI-FI PRESENTS
THE MOBILE ONE DISCO

suitable for discos, parties, clubs and many other entertainment applications.

$2200

Features: —

- Lighting control unit included
- Separate equalisation and balance controls on each input
- Attenuator pads on microphone and auxiliary inputs
- Stereo cue for each input
- VU and peak overload indicators on masters out
- More than ample level from headphone amp
- 90 RMS per channel.

Has all the functions of a professional studio mixer at a fraction of the cost. Speakers available to suit your requirements. For more information, please contact Kent Hi-Fi.

KENT HI-FI

(WHERE THE BEST EQUIPMENT COSTS LESS)

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SYDNEY
ph: 29-2743

News Digest

Toshiba Clock/Radio

For all of you out there who can't be bothered building your own digital alarm clock and radio (shame on you, and you an ETI reader), here is a smart-looking alternative. This Toshiba clock/radio has a 0.6" LED display in 12-hour format with AM/PM indicators. The clock has all the standard features of the modules that are now available, plus a few new ones: it incorporates a digital timer for elapsed-time measurement and a radio cut-off timer which is presettable in one-minute steps up to one hour. There's also the usual 9 minute snooze alarm.

Also contained within the package is an AM/FM radio about which very little can be said except that it probably works, because most Toshiba stuff does.

Coke Adds Life – and Solar Heat

Australian solar energy research has taken a leap forward with the installation by the CSIRO Solar Energy Studies Unit of the first industrial solar hot-water heating plant in Australia. The unit supplies heat to a can-warmer at Coca-Cola's factory near Canberra. 49 solar collectors, covering 77 square metres, heat water which is then stored in a 20 cubic metre tank. The heat from this is then used to warm 200 cans/min. in order to prevent condensation and possible deterioration of the cans. The solar heaters supply 80% of the annual energy requirement of the warmer.

TI Tritium LCD

Texas Instruments are continuing to battle with Timex in the watch market, and have increased their armament with the introduction of an LCD watch line. Interesting point is the use of tritium gas instead of a Battery/bulb for backlighting. Even more interesting is the fact that since tritium is radioactive a licence for its use is required from the US Nuclear Regulatory Commission, who say that TI have not yet applied to them. Several other watch companies have received permission to use the process, in which tritium inside a Pyrex glass tube excites a phosphor coating to fluoresce, providing sufficient light to outline the LCD digits.

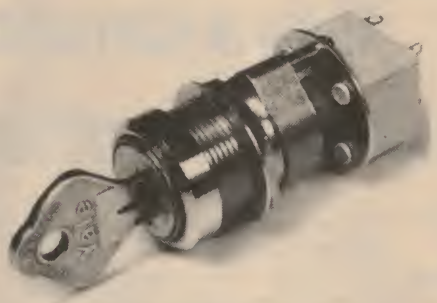
Unitrex Calculator Contest

A radio amateur erected a vertical antenna in his (perfectly) rectangular back yard. In measuring up the length of feeder cable required he discovered that his 15m tape measure wasn't long enough to go from the antenna to the garden corner where the feeder ran around the corner of the house. However, he knew that the antenna was 15m from one corner, 13m from the opposite corner, and 10m from the third corner. How far was the antenna from the fourth corner? (Hint: don't try plugging numbers in straight away, try to derive a general formula first.)

Send your answer on the back of an empty envelope (don't forget to add your name and address) and send it to: Unitrex Calculator Contest (July), ETI Magazine, 15 Boundary Street, Rushcutter's Bay, NSW 2011. Closing date is August 19th.

The winner of the May contest is R.J. McDonald of Port Hedland, W.A. The correct answer is that, to stay alive, the missionary must make four cuts in the chain. This splits it into five sections, of 5,10,20,40 and 80 links respectively, plus the resulting four single links.

Keyswitch



If you really want to go to town on the House Alarm project in this issue,. or perhaps you can't site it in a cupboard, then this piece of hardware is for you. There are a range of Yale Key-operated keyswitches available from *C & K Electronics (Aust.) Pty Ltd., PO Box 101, Merrylands, NSW 2160.* For example the type KMS shown is available with a double pole mains switch and is rated at 4 A at 250 V AC or 10 A at 12 V AC. With a two-position 60 degree movement, the key may be trapped or withdrawable in either position. These switches are stackable, and there are a large number of key combinations.

Change of Name

As from the 15th of August, M.S. Components will be known as Sheridan Electronics Pty. Ltd.

Scope Measures Time to 0.002%

Incorporating a 5-digit time-interval-averaging counter into a 100 MHz precision delta-time oscilloscope, a new instrument from Hewlett-Packard measures very short time intervals with 100 picosecond resolution, longer intervals at 0.002%.

The HP 1743A offers several improvements over earlier models. 1) Now the start of the delay can be simultaneous with trigger, so events close to the trigger can be viewed. 2) Traces can be automatically overlapped. 3) The LED readout remains calibrated when the sweep vernier is changed, so calibrated displays can be obtained with the user's choice of whole-sweep time – such as clock period in digital systems. 4) The counter timebase is a 100 MHz crystal. 5) Readings are averaged, so accuracy is improved. 6) The LED readout has five digits with 300% over-range.

The 1743A solves the classical problem of synchronizing clock-related functions in large computer systems. It will enable modern high-prf radars to be calibrated to higher accuracies. New accuracy in measuring propagation delay will affect navigation-aid design. More-accurate knowledge of logic function timing will decrease uncertainties over such matters as settling time and device variations, making it possible to decrease error margins and increase system speed.

Duty-free price of the 1743A Oscilloscope is $3715. *Hewlett-Packard Australia Pty. Ltd., 31-41 Joseph St., Blackburn, Victoria 3130.*

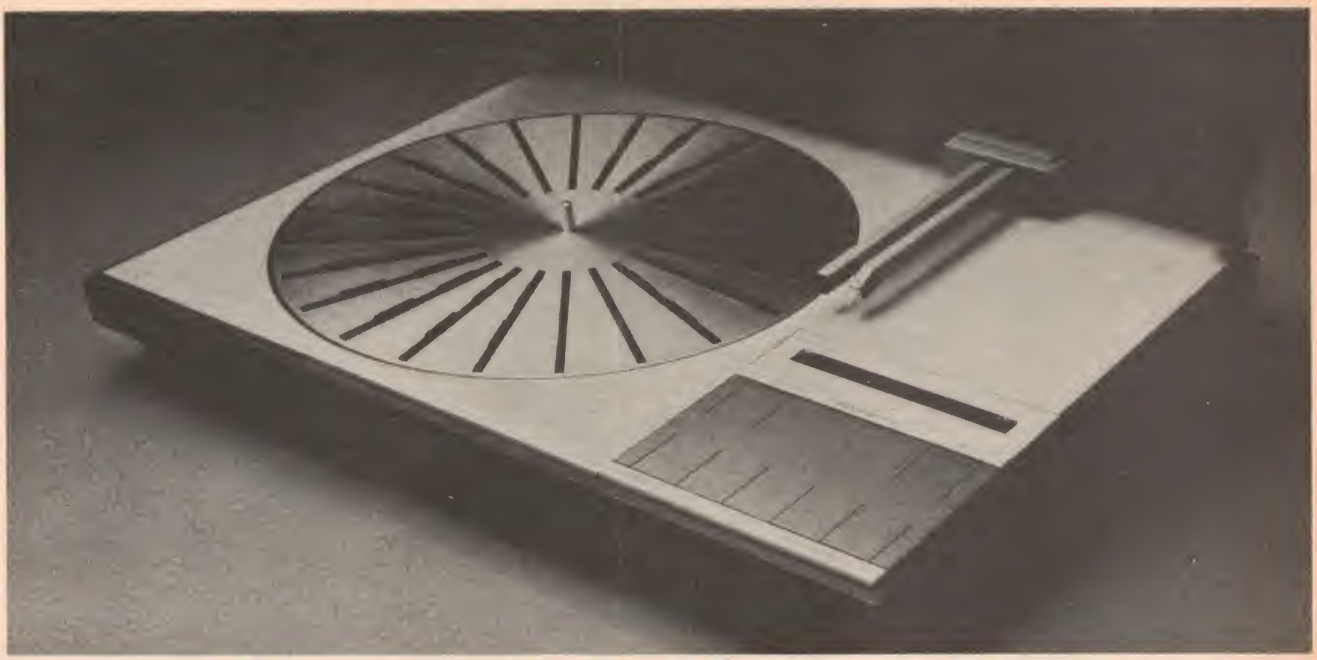
LCD Computer Terminal

IBM have developed an experimental computer terminal based on the combination of a laser and a photographic-slide sized liquid-crystal cell. The semiconductor laser is used in conjunction with a pair of computer-controlled mirrors to generate 7 x 9 dot matrix characters which are then projected at 25 x magnification onto a screen. The high viscosity of the liquid crystal material retains information written into it, and can be written into at a rate of 20 characters per second. Work is in progress to improve this speed.

ERRATA

ETI 316, May '77 – circuit diagram, Page 52. The connection between the base and emitter of Q2 is an error in the drawing, and should be deleted.

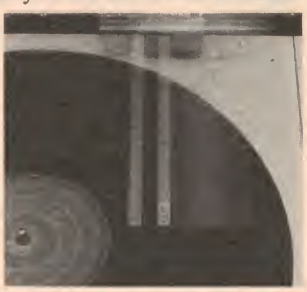
ETI 712, June 1977 – Parts list, page 58. Q2 and Q3 have been transposed, i.e. Q2 is a 2N3055 and Q3 is a BD140.



Bang & Olufsen's Superspinner! Electronically controlled Totally integrated Fully automatic-

So where's the difference?

It is important to understand right away that Bang & Olufsen's Beogram 4002 differs in most respects from any other turntable available.



It is still the only fully automatic, straight line tracking turntable in the world. It plays your records exactly as they were recorded — in a straight line from the edge to the centre instead of tracing an arc. Tangential tracking ensures that tracking angle error is greatly reduced and skating effect is completely eliminated. This combination of developments results in a sound quality that is audibly superior to all conventional turntables.

Many of today's turntables are a mass of confusing weights and pulleys, countless buttons and controls for everything that can possibly be adjusted. With some it can be quite a job just working out how to play the record.

Bang & Olufsen made the 4002 simple to use. No other record player is as easy to operate. You simply touch the "START" button and need never lift a finger before the record is to be turned. A photo cell registers the size of the record, and automatically sets the speed. Unlike most manufacturers, Bang & Olufsen masters the production of all components in an audio system — from pickup cartridge, right through to loudspeaker systems. This has made it possible to construct a totally integrated record player whose technical intricacies are concealed beneath the surface, and whose individual components work in perfect harmony.

It is plain to see that the Bang & Olufsen Superspinner 4002 has unique technical specifications which many more expensive record players cannot match.

THE BEOGRAM 4002
NOW COSTS $638.

Bang & Olufsen

simply the best.

Victoria Danish Hi Fi, Shop, 9, Southern Cross Hotel, Melbourne. Telephone 63 8930. Danish Hi Fi, 698 Burke Road, Camberwell. Telephone 82 4839. Turner Audio, 35 Peel Street, Ballarat. Telephone 32 2042. **New South Wales** Convoy Sound, 4 Dowling Street, Woolloomooloo. Telephone 357 2444. Convoy Sound, 387 George Street, Sydney. Telephone 29 4466. **Queensland** Brisbane Agencies, 72 Wickham Street, Fortitude Valley. Telephone 221 9944. **Western Australia** Danish Hi Fi, 308 Walcott Street, Mt. Lawley. Telephone 71 0100. **South Australia** Ernsmiths, 50 King William Street, Adelaide. Telephone 51 6351.

B0935

Now from Sony: the Definitive Direct Drives.

No one knows better than Sony how clearly superior the servo motor direct drive system is in turntable design — after all, we started it all more than ten years ago with the revolutionary TTS 3000. All the vast experience we've gained in producing direct drives in the decade since plus some remarkable new developments, are incorporated in this outstanding new range for 1977.

Turntables

PS8750 Photo-Electric, Direct Drive Turntable

Sony's finest turntable, ever. This is the ultimate precision instrument for reproducing sound from today's wide dynamic range recordings. Incorporates a great number of operating features developed exclusively by Sony. The performance is incredible with wow and flutter 0.025% (WRMS). Speed deviation within 0.003% , Signal/noise 70dB (DIN-B).

Features:

• Crystal-control, "X-tal Lock", system governs speed with superb accuracy compensating automatically for any variation in load/speed factors. • "Magnedisc-servo" system using magnetic auto monitor for precise speed, irrespective of voltage variations. • Direct drive servo motor provides exceptionally stable and accurate performance. • Photo-electric sensor for disc-end has no impact on cartridge or disc. • Feather-touch switch for stop/start and reject. • Entirely new moulding material SBMC minimises cabinet resonance. • Arm pipe and shell made of carbon fibre suppresses resonant feedback. • Dual supported jewel pivot. • Static insulated dust cover allows use of extremely light cartridges. • Oil-filled rubber damping mat absorbs disc vibration. • Remote viscous-damped cueing. • Tone-arm height adjustment for various cartridges.

PS4300 Photo-Electric Fully automatic Direct Drive Turntable

This is the feature-packed direct drive that audio experts have been waiting for. Total control convenience is achieved without compromise in performance. Wow and flutter a virtually unmeasurable 0.03% WRMS and Signal/noise 70dB (DIN-B).

Features:

• "Magnedisc-Servo" control automatically monitors and electronically compensates for voltage variations giving precise speed. • Brushless and slotless direct drive motor for great accuracy of speed. • Fully automatic system for start, stop, cut and repeat. • Photo-electric sensor for disc-end eliminates mechanical impact. • Auto lowering in manual operation. • Plinth made of accoustically "dead" SBMC material eliminates feedback. • Highly sensitive tone-arm and Sony high performance cartridge XL-15 included. • Anti-skating device and lateral balancer. • Feather-touch controls.

PS3300 Automatic Direct Drive Turntable

Now you can obtain the superior performance of direct drive at the price of a belt-drive! And the performance is astonishingly good with wow and flutter only 0.04% WRMS and Signal to noise 65dB (DIN-B). Aesthetically, the PS3300 is most appealing with a slim and ultra-modern appearance that will enhance any HI-Fi System.

Features:

• Brushless and slotless direct drive motor for precise, even speed. • DC-servo control monitors and electronically compensates for any spurious influences on speed. • Automatic system for arm return. Cut and repeat. • Illuminated stroboscope and electronic pitch control adjustments. • Viscous damped cueing system for protection of cartridges and disc. • Highly sensitive "S" tone arm and Sony's magnetic cartridge VL-32G included. • Anti-skate device and lateral balancer.

SONY®

Research makes the difference.

GAC.S.7902

SOUND

AM STEREO~ CLOSER THAN YOU THINK!

STEREO BROADCASTING is generally associated with FM probably because that's the way it's been transmitted up to now.

But it is perfectly feasible to transmit a stereo programme using modified AM transmitters and receivers. In fact five American-designed systems are being evaluated right now by the USA's National AM Stereo Committee whose subsequent report will be studied by the FCC later this year.

AM stereo broadcasting has the same inherent limitations as AM mono – that is a bandwidth restricted (by legislation) to less than 10 kHz. Thus the full audible frequency range cannot be transmitted and it is for this, amongst other, reasons that FM transmission is used for high quality stereo broadcasts.

Protagonists of AM stereo accept the limitations inherent in AM broadcasting but point out that the market audience they seek is not the purist FM stereo listener but the 'man-in-the-street'. They say that people are now so aware of stereo that mono reception is anachronistic, and that if AM stereo could be introduced at sufficiently low cost it would be absurd not to do so.

The main attraction of AM stereo *is* low cost. In fact it's possible to modify an existing AM transmitter to stereo operation for well under US$10,000. Certainly a low power FM transmitter costs not a great deal more, but it's a different matter for the big 100 kW plus systems.

Most broadcasting studio equipment already *is* stereo – certainly all modern recording machinery, cartridge players, record players are so made as is the majority of programme material.

Stereo AM receiving equipment could be inexpensive. Many potential AM stereo listeners already own a record player which could accept an input from an AM stereo decoder. And even if a complete AM stereo receiver were to be required, such could be built for very little more than the cost of its AM mono equivalent, (and would of course offer a whole new market for manufacturers!).

COMM. Associates:

This is probably the simplest proposed system. It is quite different from the other four. The system is called 'Frequency Approach Aperture'; the left channel modulates a carrier just below the main carrier and the right channel modulates a carrier just above the main carrier. The combined signal goes to a band-pass filter which separates out the upper sideband of the lower carrier plus the lower sideband of the upper carrier (Fig. 1). The output from the bandpass filter is the transmitted signal.

The simplest way to receive the Comm. signal is via two AM receivers – one tuned to the upper sideband, one to the lower sideband! A more elegant way is to use a receiver in which the two signals are separated by filters and then passed through two separate IF strips and demodulators.

It is important to note that this is not a matrix system. Claimed advantages are good noise characteristics, excellent fidelity and all the well known advantages of suppressed carrier single-sideband transmission.

Motorola:

This system uses circuitry vaguely similar to that used in colour TV transmission. The system called 'C-Quan' uses two carriers operating at the same frequency but separated by phase quadrature. Motorola say that a major part of their design is in the elimination of distortion caused when the stereo signal is received on mono receivers, this distortion apparently being caused by some interaction between modulation components. This problem is overcome, claim Motorola, by modulating both the in-phase and the quadrature components by the cosine of the modulation angle.

Motorola's 'C-Quan' receiver is shown in the lower part of Fig. 2. As may be seen, the IF travels along two separate paths, one to an in-phase detector, the other to a quadrature detector. Further elements then remove the cosine term (generated in the transmitter). Finally the two channels pass through synchronous detectors which recover the left channel and right channel signals.

Belar:

Originally described and demonstrated by RCA, Belar Laboratories propose a matrix system in which an L+R signal amplitude modulates the transmitter just as in mono transmission whilst the L-R signal is processed so as to frequency modulate an RF carrier which in turn modulates the transmitted AM signal.

The transmitted carrier thus contains both AM and FM sidebands. The FM sidebands contain the stereo information (i.e. the L–R signal) and the AM contains the L+R signal – the latter of course being totally receivable on any standard unmodified AM mono receiver.

Belar's proposed stereo receiver is shown in Figure 3.

Kahn:

Although more complex than the Comm. Associates proposal Kahn Communications' system is equally as elegant. Here the carrier is phase-modulated with the L–R signal and then amplitude modulated with the L+R signal. Some very sophisticated circuitry is used to produce the resultant carrier which has the left channel signal on one sideband and the right channel signal on the other.

The transmitted signal can be received in various ways. A normal mono AM receiver tuned right onto the carrier will receive the normal AM envelope (the L+R signal). Stereo reception can be obtained either by using a receiver with phase detection for separating out the L+R and L–R signals – or by using two separate mono receivers (or circuits) one tuned slightly above the carrier, the other slightly below.

The Kahn system has been quite thoroughly tried and proven by stations XETRA (Mexico) and WFBR (Baltimore). Apparently the results were excellent with good freedom from interference, and excellent mono and stereo reception. Over 15 dB separation was achieved merely by using two mono receivers, and well over 35 dB using the phase detection.

Magnavox:

This system is similar in some ways to those of Kahn and Belar. Magnavox amplitude modulates the L+R signal and phase modulates the L–R signal. A 5 Hz tone frequency modulates the carrier to provide a reference for a wide-band phase-locked loop which generates a phase-modulated signal. This signal is in turn modulated by the L + R signal before transmission.

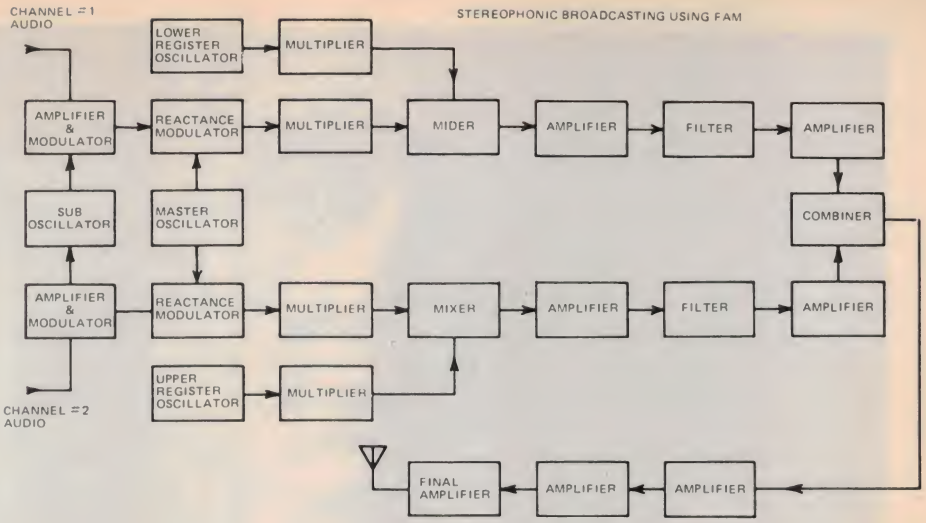


Fig. 1. The Comm Associates transmitter system uses dual RF-modulator paths, one for the upper subcarrier and one for the lower. Matrixing of L and R signals is not necessary.

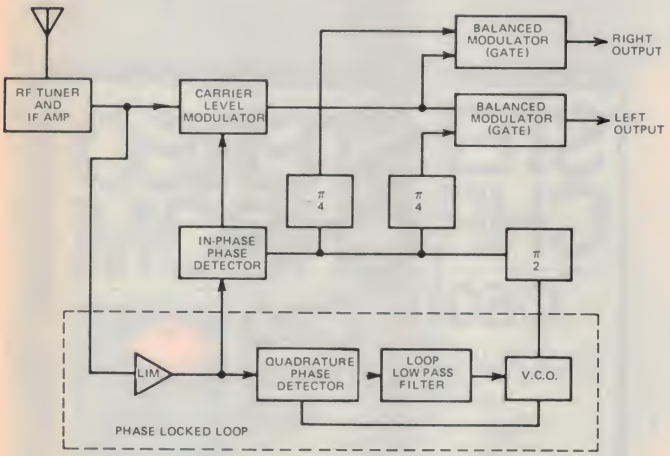


Fig. 2. Motorola's receiver employs both in-phase and quadrature phase detection. In addition, a phase shift system removes cosine modulation inserted at the transmitter.

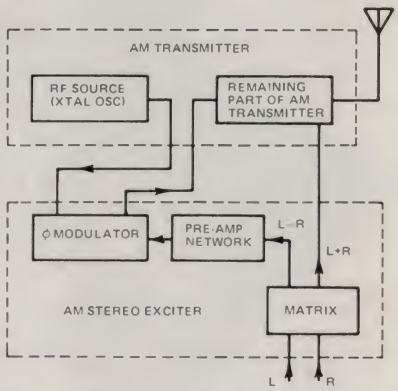


Fig. 3a. The block diagram shows how the L + R and L − R signals are routed through the Belar AM stereo transmitter.

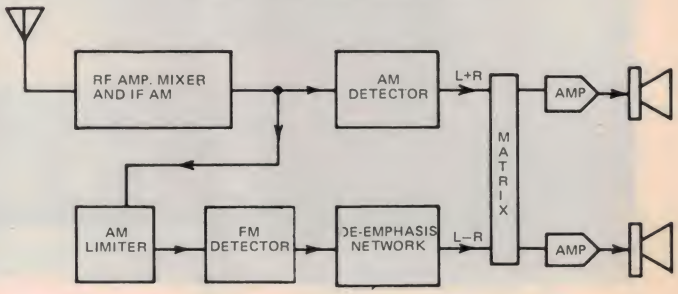
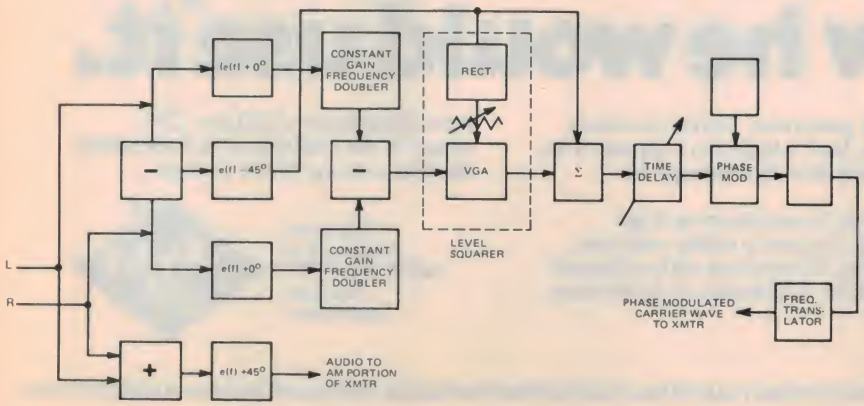


Fig. 3b. The Belar receiver has two IF paths, one to a normal AM detector, and one through limiter stages to an FM detector.

Fig. 4a. In the Kahn transmitter, the L − R signal phase modulates RF from a crystal oscillator. The L and R signals are carried by separate sidebands, and are picked up on a receiver equipped for phase detection.



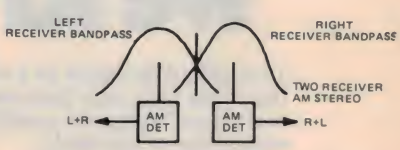


Fig. 4b. The stereo signal from the Kahn transmitter can also be picked up by two mono receivers, one tuned a little high, the other a little low.

The receiver consists of a single IF strip the output from which is then split and passed to an envelope detector (for the L+R signal) and to limiters and a phase-locked loop which demodulates the phased-modulated (L—R) signal.

At present there is no clear indication from the FCC that AM stereo broadcasting will be introduced at all — let alone any particular system. But the proposals are being taken very seriously by the FCC as well as by the companies involved. And unlike the four-channel fiasco in which manufacturers of four competitive and non-compatible systems fought to establish a hold in a largely disinterested market, AM stereo broadcasting will, if adopted, be backed by the FCC — who will also determine which system will be used.

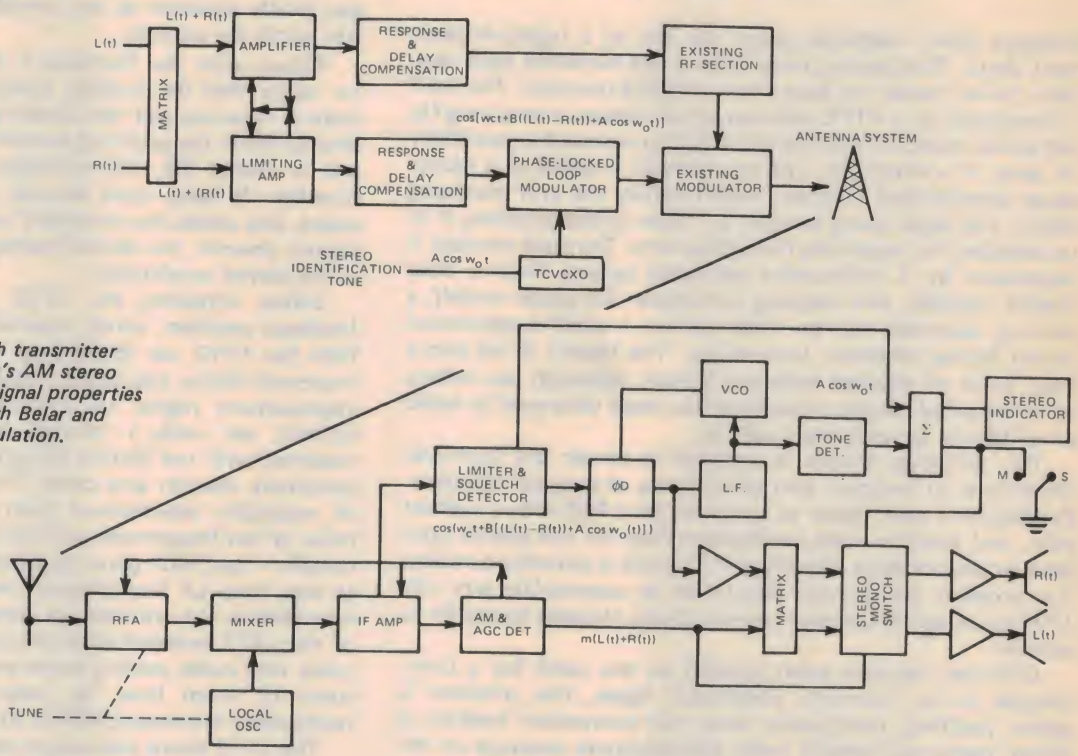


Fig. 5. Block diagram shows both transmitter and receiver stages for Magnavox's AM stereo design. The formulae detail the signal properties at various stages. In common with Belar and Kahn, the system uses dual modulation.

LINN SONDEK LP12

SCOTTISH HI-FI PRODUCTS seem to be rather rare although Glasgow-based Linn Products, already holder of a British Council of Industrial Design award for the model LP 12 turntable, looks as if it might also gain a Queen's Award to Industry for export achievement, in view of the number of LP12s sold outside the U.K. The LP12 is, of course, the redoubtable Linn-Sondek turntable, of which much has been said in the past couple of years or so since its introduction. We understand the Linn-Sondek had its origins in the Ariston, although the hi-fi industry is full of rumours in this respect. What is not rumour is Linn's claim for the unit — simply that the LP12 is the best-sounding turntable available.

This sort of claim can often be difficult to substantiate, and is always open to question. Linn has a sort of running challenge, however, one which is so smugly assumed that it's quite obvious that the outcome of the battle will be in favour of the LP12. The challenge is this: take any turntable, regardless of make and compare its performance with the Linn Sondek. Use the same arm and cartridge, and the use of an LP12 will always result in an audible improvement of performance.

Most people confronted by such an assertion are likely to ask themselves exactly how a turntable can influence a sound system's performance. This needs to be put into context. Ideally, a turntable system should extract in the form of analogue electrical signals the information carried as modulation of the record groove. But since these modulations are very small, the pickup must be very sensitive which makes it equally sensitive to other sources of vibration approaching the same magnitude — motor noise, bearing rumble feedback and the various other external vibrations likely to reach the platter surface during use. Many turntables boast very low rumble figures and have negligible wow and flutter. Most of them have two or more speeds, which the Linn Sondek doesn't. The LP12 offers only 33.3 rpm, and is a surprisingly spartan belt-drive unit.

But a close examination shows a surprising amount of detail design work. The main bearing, for example is a finely

LINN SONDEK LP12

polished cone, machined upon the end of a highly-finished steel shaft. This bearing rests upon a flat hardened steel platform which forms the base of an oil-filled reservoir. The shaft is supported by a PTFE cylinder which creates a very snug fit, the whole object of this exercise being to reduce the possibility of wear to a minimum. The oil reservoir is fitted to a heavy-gauge pressed-steel member, which carries the arm mounting board, this latter being secured by three screws enabling it to be detached for mounting the pickup arm. The steel member is suspended by a three-point springing system from a steel chassis member, this carrying switchgear for power on/off, a starting capacitor and the drive motor, a small synchronous device having relatively low torque. The chassis is set into a base made of selected seasoned timber, although we believe an unmounted version is available for those who want to build an LP12 into an equipment cabinet.

The springing system is designed to render the turntable impervious to feedback and other forms of external vibration. Pundits have been heard to compare the LP12 with a half-set jelly, and there is some justification here for the platter does tend to bounce quite alarmingly if the unit is clumsily handled. Yet properly set up, and fitted with an appropriate arm, the LP12 is, in our experience, an extremely pleasant turntable to operate.

Criticism has also been levelled at the need for a Linn-Sondek to be correctly assembled. Again, this criticism is partly justified, particularly since the instruction booklet is rather vague and doesn't really give adequate coverage of the installation procedure. This really is rather fiddly. The routing of pickup arm wiring is particularly critical since it is possible for feedback to affect the 'floating' part of the unit if the wiring is incorrectly installed. Of course, a buyer has a right to expect his dealer to supply a properly set up LP12, in view of its price, and we hope the Australian distributors have taken the necessary steps to educate their retailers and agents of the various 'dodges' so essential to the LP12's correct operation and installation.

We've been using a Linn-Sondek for a number of months now. It took, in all, some three hours to install (installation was carried out by a person with previous experience of LP12s) from unpacking to connection to the preamp. We use a JH Formula 4 arm (which also has a reputation for fiddliness although in this instance we feel the charge is unjustified) and accordingly our LP12 was ordered with a blank arm mounting board. Ready-cut boards are available for use with Grace G707 or SME 3009 series II arms, which would reduce the installation time by about an hour or so. But levelling the platter, orienting the mounting board and tying back the wiring all takes a lot of time, even if you've done it before and are aware of the pitfalls.

Some arms, including the JH, require more clearance above and below to accommodate the wiring and pivot hub than the LP12 provides. A hole must be cut in the hardboard cover fitted to the underside of the base and arrangements (such as a dome or suitable hole) must be added to the cover to enable it to close. These problems don't arise with Grace or SME arms, however.

Once installed and connected, the LP12 is likely to need further minor adjustments. The device (and we speak from experience of several) needs time to settle in.

This also goes for the JH Formula 4, which is an extremely sensitive arm and which needs to be adjusted with great care. All adjustments should be reviewed and altered as necessary at fairly frequent intervals after the system is first installed and used.

All this may appear rather daunting, although there is nothing difficult involved. There is, of course, a degree of tedium; our unit had been in use for over a month before it was finally adjusted to our complete satisfaction. But it really was worth the trouble.

Fitted with the Formula 4 arm (overseas buyers should be aware that the broadly similar design marketed by Mayware in America and the United Kingdom has less satisfactory arrangements for applying tracking force than the original JH) and a Decca Mk. 6E cartridge, the LP12 has performed superbly. It takes some seconds after switch-on to reach full speed, and unless the drive-belt is dusted with a fine coating of talcum powder, the whole floating section shudders alarmingly as the platter accelerates.

Before installing the LP12, we suffered an unpleasant feedback problem which resulted in lack of bass definition. With the LP12, we found bass far better defined, as well as improved clarity and detail. More surprising, however, was the improvement higher up the spectrum. Midrange was less strident yet with a strength and tautness not previously observed with our former (direct drive) turntable. Treble was extremely smooth and clean. This, we believe, was the result of negligible interference from self-generated and external noise at low frequencies with the LP12. It produces no audible rumble — and with good recordings, it is a complete revelation to hear deep LF fundamentals emerging from a background of near-silence. An unfortunate consequence of this is the ability of the LP12 to reveal recorded rumble from records. There are some very noisy cutting lathes around the world, it seems, and some of them have, to judge from our records, added particularly unpleasant effects to otherwise good recordings!

The LP12 seems also to give less tangible benefits, including a vastly improved stereo image. This improvement shows up not so much as better separation or definition of individual sounds within the side-to-side structure of an image, but as front-rear depth. We now observe a definite perspective from most of our records, in which overlays of sound are readily discernible. This leads to a fine sense of realism, and we're finding it far easier than before to become immersed in the music we're listening to — there is less of an awareness of reproduced sound, as if one is listening through the equipment rather than to it.

A turntable like the Linn-Sondek won't appeal to everybody. It is restricted by its single speed; care, or rather, a degree of skill (which comes through experience) is needed to operate it without causing it to go into uncontrolled oscillation when the pickup lifter is used. It looks rather old-fashioned, devoid of stroboscopic markings or any frills, and the rubber mat supplied as standard is several shades of black, the material appearing to have become stained during the manufacturing process. We've also seen a number of very curly mats (you cure this by turning the mat upside down when it's not in use!) and later examples are fitted with an illuminated rocker on/off switch, instead of the earlier push button.

But all these criticisms don't alter the fact that the Linn-Sondek is a very fine turntable. It probably does give an audible improvement over other turntables, although we hesitate to agree with the manufacturers completely on that score on the grounds that we've not heard all the competition. Nevertheless we know of no other turntable at a similar (or even far higher) price to give such good results. If you're prepared for some initial tedious setting-up after installation — and it's well worth the effort — the Linn-Sondek LP12 is certain to reward you with an audible improvement.

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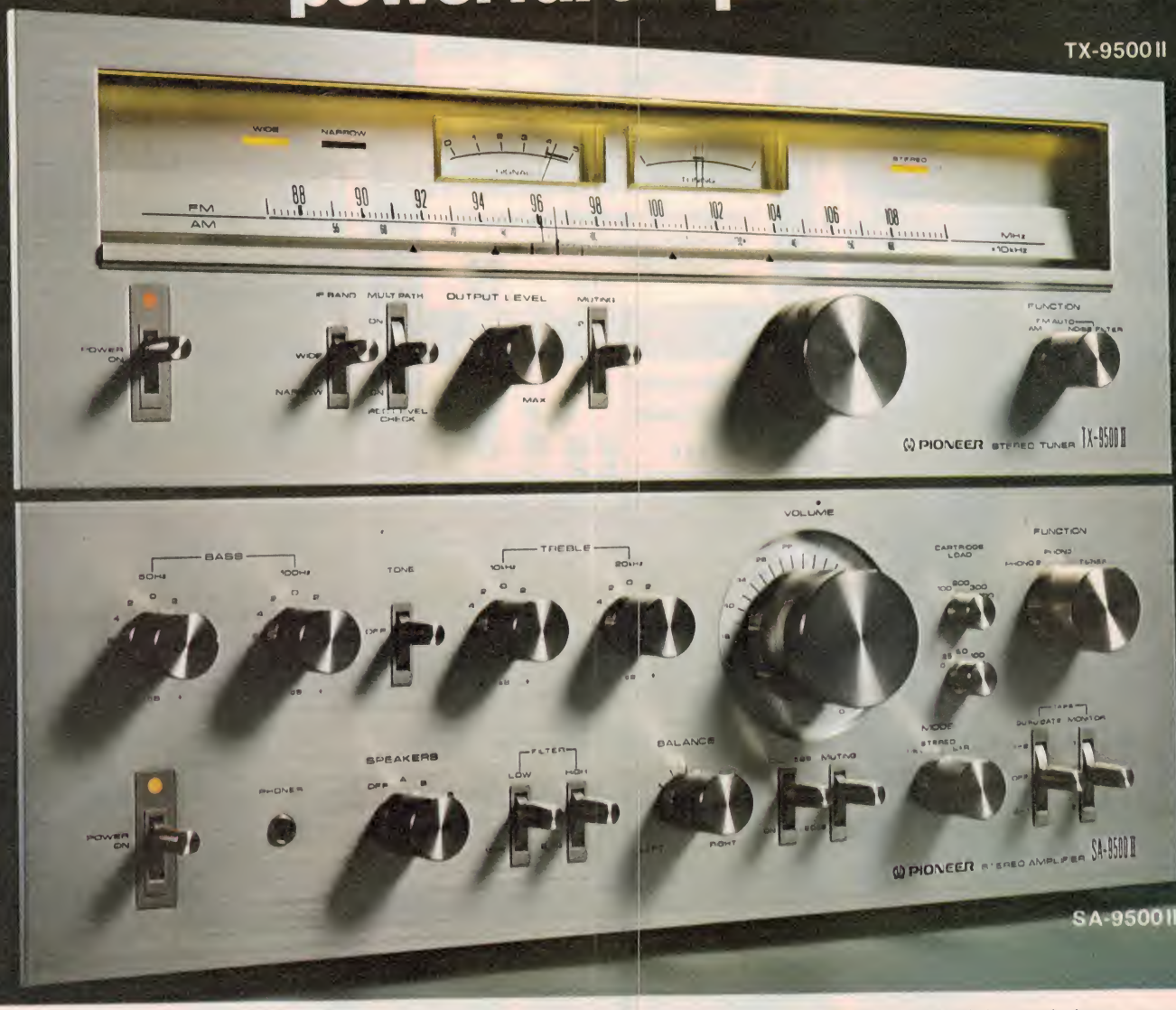

Strange as it may seem, those two concepts complement each other beautifully. And, of course, Pioneer planned it that way.

Normally, when choosing a tuner, *sensitivity* is of foremost importance because it determines the unit's ability to pull in weak or distant stations. You see, FM is subject to the same physical laws as TV. While distance is a major consideration, steel reinforced buildings, mountains or other terrain features may also reduce or partially block signals. In low-lying valleys, reception is usually difficult. These and other factors present considerable problems for clear, accurate reception. Which brings us to the Pioneer TX-9500II.

Usable sensitivity is 8.8dBf (1.5μV). What this means in your listening room is that the TX-9500II is capable of reaching out and capturing an electronic signal of incredibly weak proportions. And then holding it while it's fed into the amplifier. Naturally, the resultant increase in tonal quality will be immediately discernible by your equally sensitive ears.

All speaker systems demand power (some more than others) to produce sound. So now that you've got your broadcast locked in, an amplifier tough enough to stand up to heavy speaker requirements is vitally necessary.

May we suggest our SA-9500II. Continuous power output is 80 watts per channel, min. RMS at 8 ohms from 20 to 20,000Hz with no more than 0.05% total harmonic distortion. Inputs hardly measurable are analyzed and processed into precise impulses of acoustical energy that will ultimately reproduce every musical nuance of the original performance. The delicate and the deafening.

But, sensitivity and sheer power are only two features that contribute to exceptional performance in a tuner/amp combination. Pioneer is offering a wide line of five amplifiers and four tuners. Something for everybody. Why not stop in for a demonstration and hear about such things as a SAW filter that scrubs out distortion or a tone control system that offers 5,929 different tonal characteristics. Strange as it may seem, you can be sure it won't sound that way.

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SOUND

Since we introduced our Audio Facts column some months ago, innumerable readers have asked us to expand the present coverage we give to the technical side of audio and hi-fi.

In response, here is our new hi-fi/audio section. Its make-up will vary from month to month, depending on what's afoot, but the emphasis will be on news of developments with outstanding technical interest and/or performance.

$25,000 Hi-Fi Contest

July's issue of our sister publication *Hi-Fi Review* carries one of the biggest value hi-fi contests of all time.

Run in conjunction with Harman Australia Pty Ltd the contest involves a number of multiple choice questions: it also requires entrants to define what they mean by the term hi-fi.

Prizes are unreal!

First prize is a conservative $7000 worth and includes a $3000 pair of JBLspeakers, top Harman Kardon preamp, separate FM tuner, and Harman Kardon's latest 150 watt/channel power amp, Rabco turntable, a cartridge preamp and an Ortofon MC2 cartridge. Truly a system for the most demanding buyer!

There's no less the *six* 'second prizes' – each of a complete system worth over $2000.

Finally there's a further six prizes for under-18-year-olds – again each a complete system worth over $850.

Full details and entry forms are in the July issue of Hi-Fi Review – on sale about July 21st.

Entries may also be made by visiting any Harman Kardon dealer – see list page 23 of this issue.

Dummy Heads

The Sennheiser 'Dummy Head' system, using open-air two-channel headsets for playback, shows great promise. It encourages the writer's view that true 'surround sound' will eventually be obtained from two channels only, albeit under rather special listening conditions. It has always seemed rather curious in view of quadraphony that the human hearing system uses two ears, each of which is capable of receiving only one complex signal pattern at audio frequencies. True, high-frequency phase differences could probably be detected by different parts of the eardrum at very high frequencies but these would possibly go undetected *per se* because of the 'single channel' link between the eardrum and the chochlea.

Thus the brain receives only two sets of information, one from each ear, and it would appear, therefore, to be pointless to use four loudspeakers, each producing a different set of information, when only two are needed.

The chief obstacle to 'surround sound' is the listening room, which drastically alters the characteristics of reproduced sounds. It's probable that two channels may ultimately be used to give surround sound in acoustically dead environments in the future, and the effectiveness of the illusion will be totally dependant on maintaining correct phase, frequency and amplitude of the reproduced sound at the moment it reaches the eardrums.

Despite Matrix H, and the BBC's undoubted expertise, we are a long way yet from high fidelity in the strictly definitive sense. One can't help but feel the money spent on developing Matrix H and carrying out the experimental broadcasts might have been more effectively directed toward research into how the human hearing mechanism really works.

BBC 4-channel

With the recent announcement that the BBC has begun experimental 'Matrix H' four-channel broadcasts using the basic Zenith-GE Multiplex pilot-tone stereo FM system, it's time once again to examine the concept of four channel sound as a whole and as a means to the hi-fi end. The BBC Matrix H system is based on the Sansui SQ matrix, with altered phase relationship for rear-channel information to improve mono/stereo/four-channel compatibility. The Beeb has issued technical details of the necessary decoding equipment and has also advised the necessary changes for making existing SQ decoders suitable for Matrix H.

Whether or not these experiments will be useful is highly debatable. The four-channel surround-sound concept has received negligible attention of late although one has the impression that backroom boffins in Japan, America and the U.K. are still busily trying to get a non-anomalous system to work. Forefront of current experiments must be Ambisonics, although this appears to be a technical nightmare. Ambisonics uses a special microphone cluster consisting of four separate elements so arranged to sample a spherical sound field. The writer has heard one Ambisonics demonstration, using material recorded on cassette, replayed via a Nakamichi 1000 and linked – wait for it – to a normal two-channel system. Results from different recordings were predictably variable, although some sequences were reproduced with greater depth and spaciousness than one normally hears from stereo recordings.

Mitsubishi: Systems Galore

One of the giants of Japanese industry, the Mitsubishi Corporation, is now solidly into hi-fi with two component systems, plus a range of top-level individual units. In the medium bracket are the 200 and 300 Series, based around amps rated at 25 and 50 Watts per channel respectively, and including a tuner, two turntables, three Dolby tape decks, and the one speaker design.

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AD A4

But pride of place is taken by the up-market DA Series. A feature of the DA-A10 (100 W) and DA-A15 (150 W) amps is full channel separation. Each unit is made up of two monaural amplifiers, complete down to power supply. Mitsubishi claims inter-channel separation of better than 80 dB and the effective elimination of dynamic crosstalk.

Modular construction allows the amps to be linked in a single unit with either the DA-P10 preamp or the DA-M10 VU meter, by way of the front handles fitted to the modules.

Matching the other units is the DA-F10 tuner which features disc-type tuning dials.

The use of IC logic chips in the DP-EC1 turntable is claimed to offer a high degree of automated function without reducing the user's freedom for manual control. Photo-sensors check the size of a record and adjust speed accordingly (33 1/3 for 10 and 12-inch discs, 45 for 7-inchers): for non-standard sizes the speed can be set manually. The unit also features LED strobe speed indication and a stainless steel tone arm in conjunction with a solid die-cast alloy headshell.

Broadcast Stereo Amp

Audiosound Electronic Services of Curl Curl, New South Wales has recently introduced a stereo power amplifier of low negative feedback design. This is model L.D.40 P.M., intended primarily for broadcast applications yet soon to make its debut in domestic form. Rates at 40 watts RMS per channel, the L.D. 40 is based on all-discrete circuitry. Audiosound tell us it can produce up to 120 watts RMS in BTL mode as a mono amplifier. They claim that distortion at any output level is less than 0.1% from 20 Hz – 20 kHz and that the high frequency response has been tailored to reduce RF interference. Rise time is therefore rather low by comparison with some modern amplifiers – although we're not really sure of the point of the very rapid rise-times which are often specified nowadays.

Settling time of the LD40 is very short, even with highly capacitive loads. The amplifier has low TID (transient intermodulation distortion) at, perhaps, the expense of ultra-low harmonic distortion which could otherwise have been achieved (presumably) using a higher level of negative feedback. Even so, harmonic distortion is very low indeed for a unit of this type. More than 200 of the Professional versions of the LD40 have been ordered by the A.B.C.

The domestic version differs only by virtue of its mains connector – a three-pin Bulgin rather than a four-pin Cannon connector. All signal connectors are via Cannon three-pin sockets, and these also can be interconnected to give bridged operation without the need to alter internal wiring.

We will be receiving a sample LD40 for review before long. Our initial impressions, after a short audition, were of a very smooth, clean sound, with plenty of detail yet no apparent hardness. Also on its way, though likely to be some time yet, is the LD50 controls unit which will have a minimum of controls but will include two pickup input facilities – one for medium-low output magnetic cartridges, and another for very low output moving coil pickups. We very much look forward to examining these two Australian products in greater detail.

Planar Speakers From Kemtronic

The SFD diaphragm units developed by Japan's Sawafuji Dynameca company will soon be available as the basis of thin planar speakers. Used in the "Kemtronic" brand headphones marketed by Lawrence and Hanson Pty. Ltd. of Melbourne, the units have a 12-micron mylor film diaphragm with a 9-micron spiral aluminium coil on both sides, sandwiched between a pair of two-pole ferrite magnets.

Between eight and 256 SFD elements can be mounted on a board to produce a plane-wave speaker which doesn't face the cost and production problems of designs based on larger diaphragms. About 40 mm in diameter, the SFD elements are a mere 12 mm thick, which leads to an extremely thin speaker!

Samples of the actual speakers will shortly be available, but in view of the high cost factor of the finished items, it has been decided to import the components and make them available for the home constructor. The SFD units will also be marketed under the "Kemtronic" label.

Consumer Electronics Show 1977

This year's Sydney Consumer Electronics Show is shaping up to be even bigger and better than last year's truly outstanding effort. It has to be – it's going to be twice the size!

The venue is the Sydney Hilton (259 Pitt St, Sydney). The show is open to the public on the following days:

Thursday 4th August 6.00 pm – 10.00 pm.
Friday 5th August 10.00 am – 10.00 pm.
Saturday 6th August 10.00 am – 6.00 pm.

Trade days are:

Sunday 7th August 10 am – 6.00 pm.
Monday 8th August 10.00 am – 6.00 pm.
Tuesday 9th August 10.00 am – 6.00 pm.

Don't miss this truly outstanding exhibition. Everyone in the hi-fi industry will be there, and from what we have been told off the record there's a whole swag of new products being released.

Electronics Today and Hi-Fi Review will be there too. We have a room on one of the upper floors. Why not come up and tell us what you'd like to see in your magazines.

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Soundcraftsman,
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Selim Electronics,
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Southern Sound,
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Contemporary Sound,
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Albury Audio Centre,
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Western Australia

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SINCLAIR CAMBRIDGE PROGRAMMABLE

Don't be fooled by the tiny size — this is really a programmable calculator, and a useful one at that! — **Les Bell reports.**

MOST OF OUR READERS are involved with circuit design or other vaguely mathematical problems from time to time. In fact some may actually use Bessel functions, Chebyshev polynomials and other frightening beasts from the mathematical night.

A common requirement is to solve a problem repetitively; for example, a filter design may have to be optimised and values recalculated — a long and tedious job. This is where the programmable pocket calculator comes into its own — you can load in the keystroke sequence required to do the job and then run that program as often as you want.

The problem is that programmable pocket calculators are expensive; true, they're getting cheaper, but not fast enough for most of us. But at last, the programmable is down in price to the stage where even schoolkids can afford to use one. The company behind this move is Britain's Sinclair Radionics.

The Sinclair Programmable

Sinclair have been producing the Cambridge range of pocket calculators for a good few years now and the design has stood the test of time pretty well. There have been a few minor changes, both internal and external, since the original models, but none so big as with the introduction of the Cambridge Programmable.

Sinclair have had an earlier attempt at a programmable calculator as an extension of their Oxford series, but the machine was not very successful from the design point of view — it abused Reverse Polish Notation (no stack!) and could best be described as quirky in its operation. Fortunately, Sinclair have sorted out the good points from the bad and used the best ideas in producing the Cambridge version.

The Cambridge format is tiny — only 110 x 50 x 17 mm with 19 keys, and this makes for a very busy keyboard indeed. All the numeral keys have three functions, i.e. digit entry, and up-shift and down-shift functions. Because there is little space between the keys, the legends are a little cramped and confusing, but with practice you soon get to know your way around.

Neat Trick

Very neat trick No. 1: when in the program-entry mode all the numeral keys are automatically interpreted as upshifted functions, unless preceded by a 'hash' symbol. This saves a fair number of keystrokes, but if you're not used to it, you forget that symbol and your program goes berserk. Back to square one, and more practice.

This is the animal slightly larger than life; you can see how crowded the keyboard is.

Apart from the mere ability to parrot-fashion execute sequences of keystrokes,. an important facility offered by many programmables is that of decision-taking. This enables the calculator to act differently on different input values, or more importantly, to loop around, performing an iterative calculation until an accurate enough result has been achieved. A good example of the need for decision-making capabilities occurs in games such as 'Lunar Lander', where the calculator has to decide whether you're at a height of less than zero feet, in which case you've landed, and the calculator now works out your terminal velocity.

The Cambridge Programmable does have rudimentary conditional branching, in the form of a 'go if neg' instruction, which jumps to a specified line number if the result is negative, or continues otherwise.

The calculator is a little bit awkward to use at first, for a variety of reasons: just to get into the program mode you have to press seven keys, and every time you reset it to step 0 to run a program, it displays the first step.

Handy Wrinkle

Rather than reset the machine to the beginning of your program by hand, insert the sequence 'downshift/goto/0/0' at the end (if you have room) and when the machine halts at the end of the program, pressing 'RUN' will automatically reset the machine to step 0. Clever stuff, innit?

There is a wide variety of scientific functions on the C.P. including all the trig functions, which operate in radians.

In addition, there are all the standard technical functions, (except log and antilog to base ten), and degree/radian conversions. On top of all that there are the usual exponent entry, sign change, memory functions, etc., and also the program control and editing keys. This makes for a crowded keyboard, but after a little practice, this is no problem.

The major failing with this calculator is, we feel, the lack of accuracy on the log and trig functions. While these are probably good enough for everyday use, there is considerably more importance attached to accuracy in a programmable calculator. The reason for this is simple: if one is using an iterative technique to, for example, find a root of an equation, then the calculator is going round a loop, using the result of the last run through the loop as the input for the next. It is possible to go round a loop of this nature hundreds, or even thousands, of times.

Now, if the loop includes a log or trig function, the first time round the loop an error will be introduced into the calculation, which may not be very large; but the second time round the loop the error is compounded, the third time it is still greater, and so the error is multiplied through the calculation, possibly reaching the same order of magnitude as the correct result.

We found that the e^x (or exp) function was a bit hairy; for example, exp (1) gave a result of 2.7179766, as opposed to the correct answer of the transcendental number e, which equals 2.718281828.... This is an error of 0.012% (!). The trig functions had lower errors — compare these results with the correct answers in brackets: sin $\pi/2$ = 0.9998814 (1), cos $\pi/2$ = 0.0154012 (0), tan $\pi/2$ = 64.95699 (infinity), sin π =0.0814007 (0), cos π = 0.9966814 (−1), tan π = 0.0816717 (0). In each of these cases the error symbol lit on the display. For mid-range values: sin $\pi/3$ = 0.8658722 (0.8660254034), cos $\pi/3$ =0.5002651 (0.5), tan $\pi/3$ = 1.730829 (1.732050806).

These results are not stunningly accurate. The accuracy is adequate for most everyday applications, but has to be watched in iterative programs. Who needs 12-digit accuracy anyway — there is virtually nothing in the Universe that can be measured that closely, so that five or six digits suffice for most calculations. We shall qualify our comments later when discussing the innards of the machine.

Other minor moans: the 'power bulge' in the back of the machine is not very elegant, and there is no y^x function. Both of these are only minor quibbles.

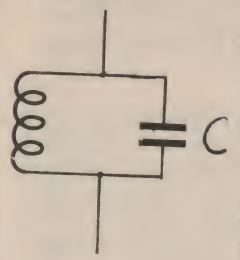
Innards

Very neat trick No. 2: when you open up the back of the calculator you will be pleasantly surprised to discover that there is nothing inside to go wrong (well almost). There is one calculator chip, one digit driver chip, a capacitor, and a display and keyboard. The keyboard is Sinclair's standard design, the digit driver is National Semiconductor's standard design, the capacitor is ITT's, and the display, although made by National, is not standard, and is presumably specially made for Sinclair.

But the calculator chip is the real belle of the ball. It is National's MM5799 Controller Oriented Processor (COPS), a MOS/LSI device which can scan up to 56 keyboard switches, can output BCD or 7-segment data, and has serial I/O ports for expansion to external memory and peripherals such as printers. On the chip are 384 bits (96 digits) of RAM, and 1536 bytes of ROM, an ALU (Arithmetic and Logic Unit), and an on-chip clock plus lots of other bits of logic. The ROM is mask-programmed, which is an expensive operation and only economical for quantities in the tens of thousands, so don't go out and try to buy one! This device is really an 8-bit microcomputer organised to do BCD arithmetic.

Despite being made in England, it doesn't work by springs and gears.

RESONANT FREQUENCY OF A PARALLEL TUNED CIRCUIT



Solves $f = \frac{1}{2\pi\sqrt{LC}}$

Execution sequence:

C/×/L/RUN/(f_o)

(Note: pre-execution calculate LC, then press RUN)

=	−	00
√x	1	01
×	.	02
#	3	03
3	3	04
.	A	05
1	1	06
4	4	07
1	1	08
5	5	09
9	9	10
2	2	11
7	7	12
×	.	13
#	3	14
2	2	15
=	−	16
÷	G	17
=	−	18
stop	0	19
▼	A	20
go to	2	21
0	0	22
0	0	23

And here we discover why the Sinclair is not too hot in the accuracy dept. With only 1.5 Kbytes available for their calculator microcode, just getting in a reasonable number of scientific functions would be very tricky, and making it programmable would be very tricky indeed. Now, for a calculator application, the COPS processor seems to have rather more RAM than is required for the amount of ROM; and so we suspect that Sinclair's designers found themselves stuck with a tricky decision. They could either provide a comprehensive and accurate straight scientific, which would fully utilise the ROM but leave a lot of spare RAM, or they could omit some of the functions and/or compromise on the accuracy, thereby releasing some ROM to implement programmability — the program could then be stored in the 40-odd spare nybbles of RAM.

Well, they went for the programmable; I would have, too. The loss of accuracy is easily tolerable in exchange for programmability. The problem with iterative loops is not a serious one — perhaps one of our readers who has time to spare may like to do a study of this, as we just haven't had the time. Iteration is a useful technique for solving equations of the form $x = f(x)$, e.g. $x = 1/x + 4$, but this is only one application for programmable calculators, and most will not be troubled by accuracy considerations.

Now that Sinclair's engineers are fully aquainted with the COPS processor, it is quite probable that they will produce other calculators using it — a financial machine is particularly appealing, since another standard COPS chip provides a complete interface to a Seiko printer.

Program Library

Here is very neat trick No. 3: due to the fact that the calculator is algebraic, strange and very non-obvious keystroke sequences can be used to perform useful functions — the most obvious one is that pressing x twice performs squaring. These tricks considerably expand the power of the calculator, but unfortunately they are not explained in the manual (which we reckon gives you all the information you need, but only just).

The main source of information is Sinclair's Program Library. Seeing that a major attraction of the machine would be a large amount of readily-available software for people who do not wish to write their own programs, they have compiled a collection of 294 programs relevant to a wide variety of disciplines. Their application programmer obviously understands the machine fully and uses every trick in the book to maximise the power of his programs. The 4-volume Program Library is worth every penny, even if you never use half the programs, but also for what you can learn from it.

Σ

Or, summing up (sorry, I couldn't resist it!). The Sinclair Cambridge Programmable is an enthusiast's machine. Experimenting with it will pay off handsomely, especially if you take the time to work through some of the programs in the Library and figure out just what the calculator is doing. If you're not very enthusiastic about calculators, and don't really need a programmable, forget about this one you'll get fed up with the fiddliness of the key sequences, and probably give up.

Although we have been pretty critical, we reckon we have covered just about all the failings of this calculator, and if these are all there are, then it stands head and shoulders above similarly priced calculators. It offers superb value for money, virtually unlimited capability, and a lot of fun. We confidently predict that it will be popular with our readers, so if you write any interesting programs let us know about them and we'll pass them on (either in Ideas for Experimenters or, perhaps, a special feature). We'll set the ball rolling with a tuned circuit resonant frequency routine.

Sinclair Cambr·

An astonishing

ELECTRONICS TODAY INTERNATIONAL has arranged with the Consolidated Marketing Corporation to supply ETI readers with this unique calculator at a special introductory price of $39.95 (plus $2.50 postage and packing) — or a mere $36.00 (plus the $2.50 p&p) if you can supply a sales tax exemption form!

Please note that this offer is limited to a period of 45 days from the on-sale date of this issue.

Sufficient stock will be held by Consolidated Marketing Corporation to cater for the first wave of orders. Arrangements have been made for express delivery of further units.

We must ask readers to expect a delay of between three to four weeks before delivery.

How pocket calculators grew up

A couple of years ago, calculators took a step forward. Programmability transformed the slick slide rule calculator into an advanced scientific machine. Sadly, it also transformed a cheap little calculating aid into a piece of capital investment. *Now the all-new Sinclair Cambridge Programmable puts programmability where it belongs: in the palm of your hand, for less than $40.*

The features of the Sinclair Cambridge Programmable

The Cambridge Programmable is genuinely pocketable. A mere 4½"×2", it weighs about 2 oz. Yet there is absolutely no compromise in the package of functions it offers. Because the Cambridge Programmable is both a *scientific calculator* with memory, algebraic logic and brackets (which means you enter a calculation exactly as you write it), and a *programmable calculator* which offers simple, flexible through-the-keyboard program entry and operation.

The Cambridge Programmable has a 36-step program memory, and features conditional and unconditional branch instructions *(go to* and *go if negative).* There is also a step facility, which allows you to step through the program to check that it has been entered correctly.

If there is any programming error, the learn key allows you to correct single steps without destroying any of the remainder of the program.

To achieve this, each program key-stroke has an identifying code, or 'check symbol' (The symbols for the digit keys are the digits themselves, while the symbols for the operator keys are letters printed beside the keys).

The check symbol for ⊟ , for example, is F. So if, as you step through the program the display shows

·idge Programmable.

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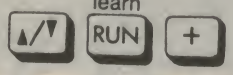
it means that ⊟ is programmed as step 26. If step 26 should have been ⊞, all you have to do is press

learn

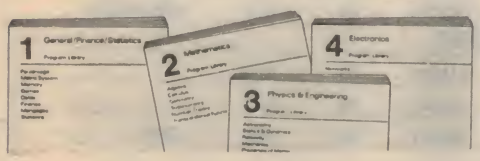


puts machine into 'learn' mode. **the correct step**

It's as simple as that!
These facilities make the Cambridge Programmable exceptionally powerful, whether it's running programs you devise for yourself or the programs in the Program Library.

Use the 294-program library to tailor the machine to your own specialty
Like a full-size computer – and *unlike* far more expensive specialist calculators – the Sinclair Cambridge Programmable can be programmed to handle calculations concerned with *any* speciality.

Programs
The calculator is supplied with twelve sample programs and full instructions for entering your own programs.



Sinclair also have available a four-volume program library in a neat hardback cover. This library contains a total of 294 programs covering –
- General Finance/Statistics
- Mathematics
- Physics and Engineering
- Electronics.

Using these standard programs, the calculator may be used to solve problems from quadratic equations (where the program gives both real and imaginary roots) to twin-T filter design and from linear regression to bond yields! It even includes a lunar landing game! To realise the full power of this remarkable calculator the four-volume library is a *must.*

The library is available at the very attractive price of $11.50. Please note that the library can only be supplied as a four-volume unit – we cannot provide individual parts.

Why the Cambridge Programmable costs so little
The Sinclair Cambridge Programmable uses the Sinclair talent for miniaturisation to the full – as you'd expect from the company that pioneered the truly pocketable pocket calculator, and recently introduced the world's first pocket TV.

One year guarantee!
The Sinclair unit is guaranteed for a period of twelve months from date of purchase.

GENERAL

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Students and some businesses may be able to claim sales tax exemption. If applicable the order must be accompanied by a duly signed sales tax exemption form. Businessmen will not need advice on this! Students should contact their administration department for details.

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Guarantee
Twelve months from date of purchase with free exchange of faulty units (return postage must be paid by purchaser). Please return faulty units to Consolidated Marketing Corporation, 308-312 High Street, Kew, Vic. 3101 not (please not) to ETI.

Period of offer
Closing date – September 5th.

To: Electronics Today International, 15-19 Boundary Street, Rushcutters Bay, NSW 2011.

Please send me (qty) Sinclair Programmable(s) at $39.95 each, including instructions and sample programs.
Price includes sales tax. $

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A (line adaptor(s) (battery saver) @ $8.50 each $

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DEVICE	MEMORY SIZE	ORGANI-SATION	OUTPUTS	PINS	MAX ACCESS TIME	FULLY COMPATIBLE ROM
82S23/123	256	32 x 8	OC/TS	16	50	82S224/223
10139	256	32 x 8	OE	16	20	
82S27	1024	256 x 4	OC	16	40	
82S126/129	1024	256 x 4	OC/TS	16	50	82S226/229
10149	1024	256 x 4	OE	16	17	
82S114[1])	2048	256 x 8	TS	24	60	82S214
82S130/131	2048	512 x 4	OC/TS	16	50	82S230/231
82S115[1])	4096	512 x 8	TS	24	60	82S215
82S140/141	4096	512 x 8	OC/TS	24	60	82S240/241
82S136/137	4096	1024 x 4	OC/TS	18	60	82S286/237
82S180/181*	8192	1024 x 8	OC/TS	24	100	82S280/281
82S184/185	8192	2048 x 4	OC/TS	18	100	82S284/285
82S190/191*	16384	2048 x 8	OC/TS	24	125	82S290/291
SIGNETICS ERASABLE MOS PROMS						
1702A	2048	256 x 8	PMOS	24	650	
2704*	4096	512 x 8	NMOS	24	450	
2708*	8192	1024 x 8	NMOS	24	450	2607

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The Technical Equalizer

The primary function of the MXR StereoGraphic Equalizer is to provide precise compensation for aural tone quality discrepancies that may be caused by room acoustics, speaker inadequacies, or program source quality.

The MXR Equalizer is a 2-channel frequency equalizer that offers 10 bands of discrete adjustment on each channel. Nominal centre frequencies are: 31hz, 62hz, 125hz, 250hz, 500hz, 1khz, 2khz, 4khz, 8khz and 16khz. Each of these octave bands may be cut or boosted independently to plus or minus 12 decibels by using the slide controls. The MXR StereoGraphic Equalizer features a bypass switch which enables the user to switch the equalization in and out of the signal path for instant sound comparison. The unit has an internal power supply and is designed to work into output loads of 600 ohms or higher. These input and output characteristics make the MXR StereoGraphic Equalizer compatible with any stereo Hi-Fi equipment.

The Creative Equalizer

Become creative with the MXR StereoGraphic Equalizer whether you want to decrease the "boomy" mid-bass sounds or increase the deep-bass sounds, decrease nasality, harshness or shrillness or move the sound source closer or further away, it's all at the touch of a slide control. Tailor your playback to suit any number of variables and develop the mood you want to hear. The MXR StereoGraphic Equalizer is compact, stylish and handsomely packaged in brushed aluminium with walnut side panels. Its design and circuitry will complement any modern Hi-Fi system.

At MXR, we combine engineering excellence and creativity to provide you with superior products.

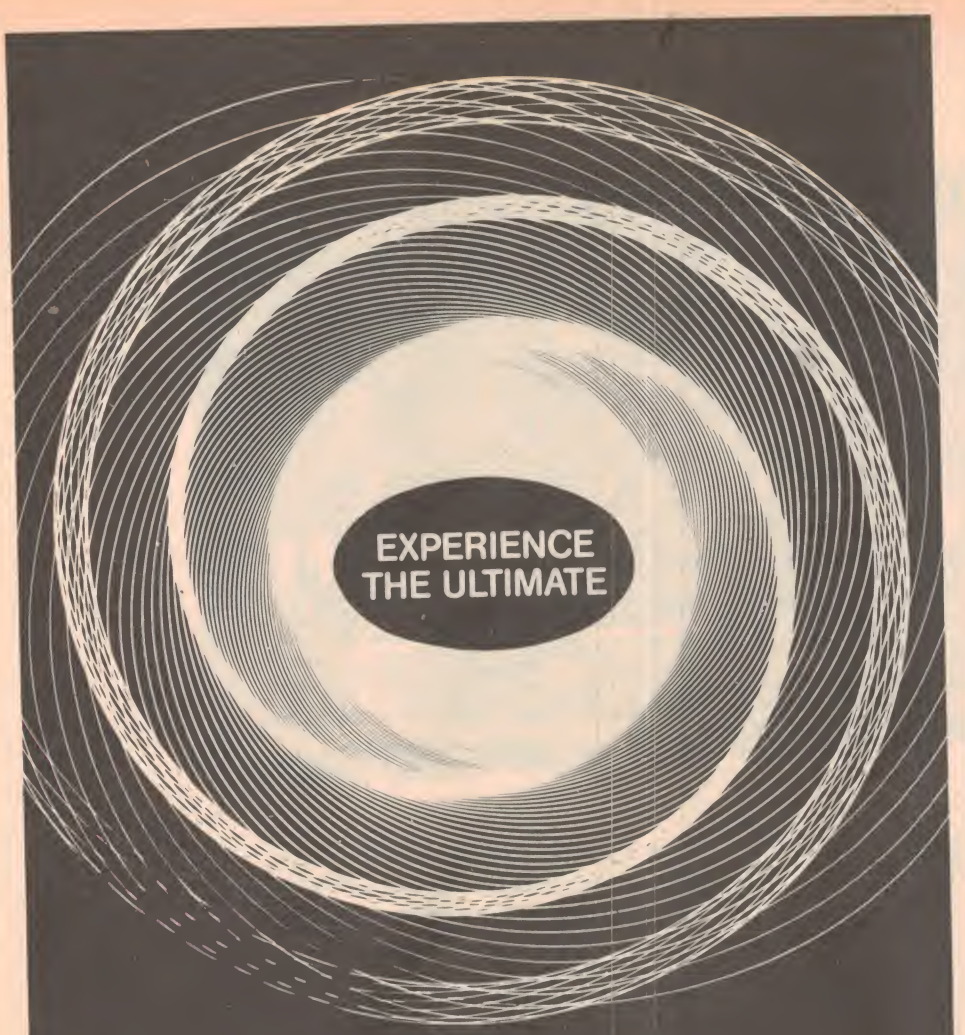
Full two year warranty

MXR $299

Creative Technology!

The MXR StereoGraphic Equalizer

For more information see Farrell Music or Farrell Keyboards at Brookvale, N.S.W., or your nearest hi-fi or MXR dealer.



The 2nd Australian Consumer Electronics Show

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Also you can view an enormous range of other consumer electronics equipment such as colour TV, radio, cassette decks, calculators, digital watches, etc. The 1st Australian Consumer Electronics Show held last year, was acclaimed Australia-wide. **This year it's twice as big.** Twice as exciting.

Although this is primarily a show for the Consumer Electronics Trade, special hours have been allotted for the general public. This is a unique opportunity to view the latest equipment from all over the world, a preview of the products which will soon be on the market.

HOURS

Thursday August 4
6.00 — 10.00 pm public

Friday August 5
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Saturday August 6
10.00 am — 6.00 pm public
7.30 pm — Gala Banquet — trade only

Sunday August 7
10.00 am — 6.00 pm trade only

Monday August 8
10.00 am — 6.00 pm trade only
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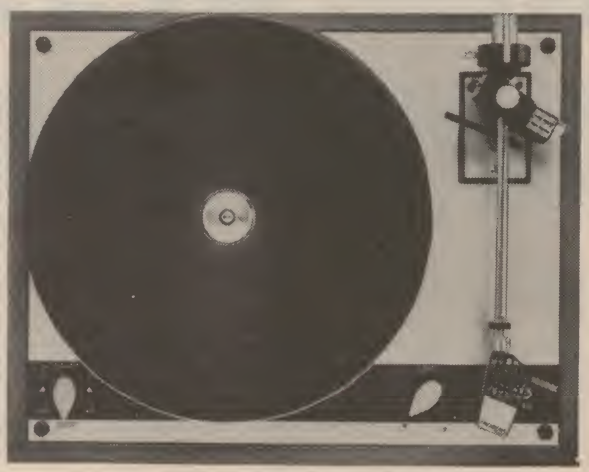

TD145 MKII. 1 step belt drive with 16 pole two phase synchronous motor. Special Isotrack tone arm is dynamically balanced to prevent external shocks and acoustic feedback. Auto-stop feature.
Excellent performance for a modest price.

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Watts Dust Bug. Automatically removes static charges and dust as record plays. Fits all turntables Easy to connect.

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SIMPLE COMPRESSOR EXPANDER

Our new compressor expander uses a single IC to replace several components in a previous design, and features a 2:1 compression ratio.

CASSETTE RECORDERS are becoming more acceptable in the hi-fi situation as the use of narrow gap heads and special tapes improves frequency response. In this respect the modern deck rivals the reel-to-reel machine. However, the reel machine and disc recording still offer a better dynamic range, a result of the signal to noise ratio of the cassette equipment not being high enough to blank out background noise in quiet passages.

When recording tapes there has to be a compromise met between signal to noise ratio and clipping the peaks of the music due to tape saturation. Many systems have been devised to help alleviate this problem with the most commonly known one being the Dolby system. This effectively gives an additional 10 dB or so of dynamic range. Limiters are used on a lot of recorders to prevent tape saturation but these alter the dynamic range which is not normally acceptable to the hi-fi listener.

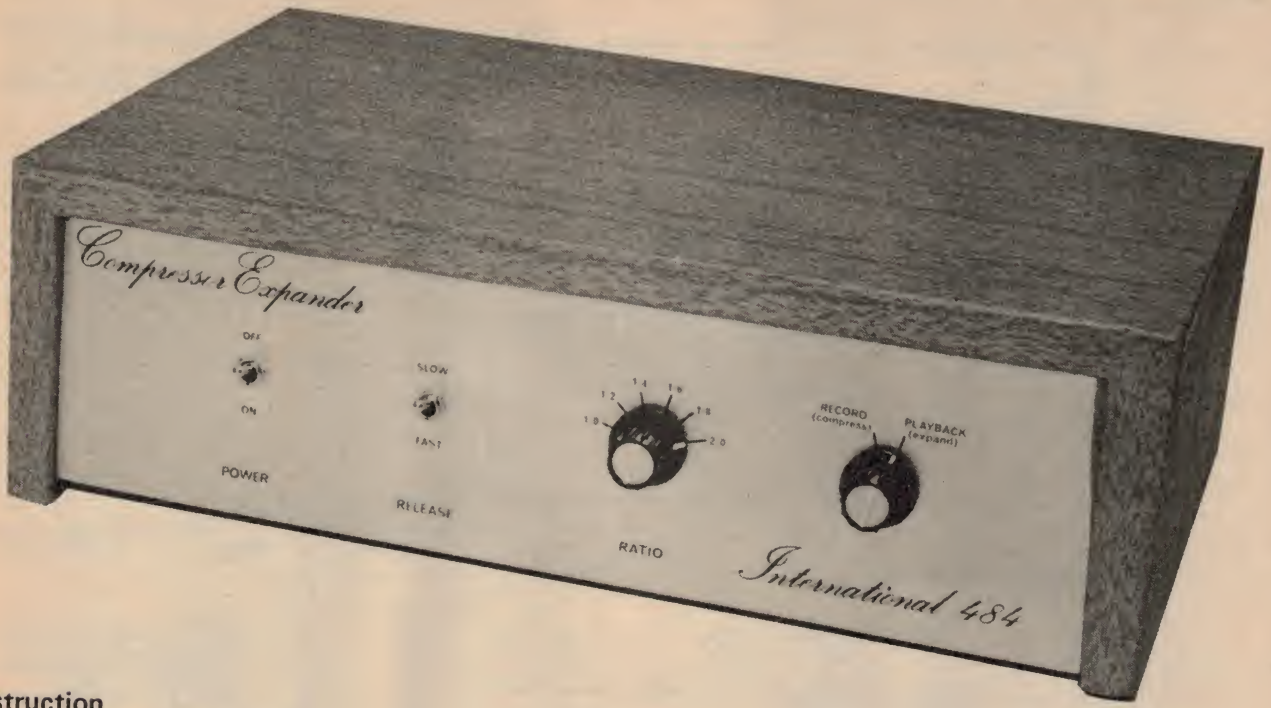
One other system used professionally but not a great deal in the domestic situation is the compressor expander. The best known system here must be the dbx unit. With this type of system the full dynamic range, say 80 dB, is compressed to perhaps 40 dB (compression ratio of 2), then it is recorded. If the signal to noise ratio of the recorder is 50 dB and our peak recording level is 5 dB below maximum our minimum level is still 5 dB above the noise. On replay we now expand by the same factor giving us our full 80 dB dynamic range with the noise 10 dB lower.

We have already published the design of a compressor expander (in ETI, April 1976) which worked well but was complex and used a double sided printed circuit board with eight ICs and four dual transistors. This new design is simplified by the use of a special IC which takes the place of all these separate components reducing the cost and complexity.

SPECIFICATION – ETI 484

Compression ratio	**1.0, 1.2, 1.4, 1.6, 1.8, 2.0**
Expansion ratio	**1.0, 1.2, 1.4, 1.6, 1.8, 2.0**
Attack time	
fast	10ms
slow	40ms
Maximum input voltage *	
R25–R28 = 0Ω	1 volt
Distortion 1 volt out	
untrimmed max.	2%
untrimmed prototype	0.25%
trimmed max.	0.2%
trimmed prototype	0.09%
Signal to noise ratio re 1V	
2.0 compression	45dB
2.0 expansion	90dB

* The max. input voltage can be increased to 3 volts using R25,26 = 22k and R27,28 = 10k

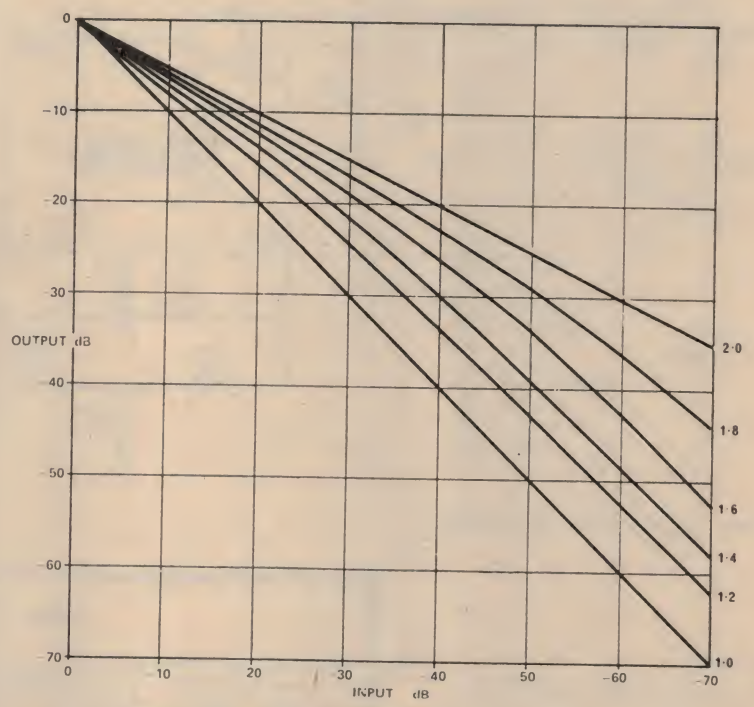


Construction

Commence assembly with all the components which are mounted flat on the printed circuit board. If, and only if, you have distortion measuring equipment add RV1, 2 and R29–R32. If these are not adjusted correctly the distortion may well be higher than without them (it should be less than 2%). Now add to each rotary switch ½ inch long 6BA spacers on the bolts holding the switch together. It may be necessary to remove the rear nuts to give enough thread to hold these spacers. Now bolt the switches onto the printed circuit board (the 6 pos. one is the nearest the IC). Take note of which contact is the wiper on each of the switches. On the 6 pos. one there is a normal contact as well as the wiper in the same position except on the opposite side of the wafer and this normal contact is not used.

There is a series of holes in the printed circuit board around the switches in two rows, one slightly outside the other. The inner row connects to the wafer closest to the printed circuit board. Start connections by the wiper contact (marked W on the printed circuit board) using tinned copper wire and then the other contacts by the appropriate resistor or link. For the links to the top wafer it is recommended that insulation be used over the wires.

The release time switch can now be wired and the printed circuit board mounted into the chasis. The transformer input sockets etc. can now be mounted and wired.



Graph showing relationship between input and output for the various compression ratios.

Distortion Adjustment

Distortion can only be adjusted with a meter. Set the ratio switch to 2 and feed about 1 to 1.5 V at about 1 kHz into the socket marked 'to tape output on amplifier' and measure the distortion at the socket marked 'to tape recorder input'. By adjusting RV1 and RV2 depending on which channel you are measuring it should be possible to adjust the distortion to under 0.2%. This can be repeated with the second channel.

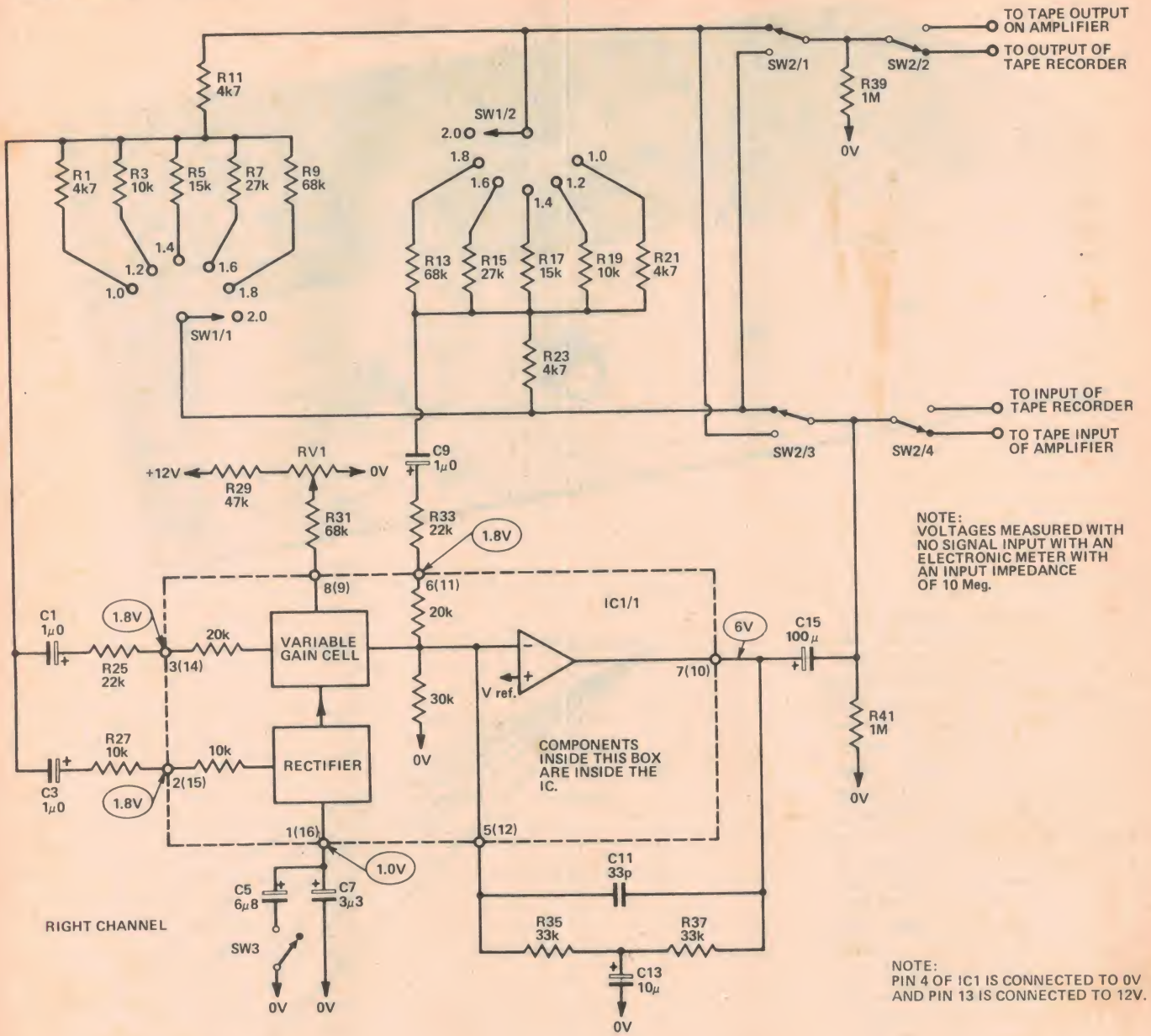


Fig. 1. Circuit diagram of the right channel.

Input Levels

The maximum input level the IC can handle is 2 volts peak. However by using the resistors R25 – R28 the maximum level is increased to 4 volt peak. They also affect the unity gain voltage and as signals higher than 2V will not be used these resistors should be replaced by links. Resistors R33 and R34 should also be replaced by links if R25 – R28 are.

How It Works – ETI 484

As most of the work is done inside the IC we must look inside the IC to explain the operation. The IC contains a rectifier circuit which is used to measure the actual signal level, a variable gain block which is controlled by the output of the rectifier so that the gain is proportional to the input signal, and an amplifier. By connecting the IC in various ways either a compressor or expander can be formed. We can do either by switching and also by mixing the two by a series of resistors we obtain ratios other than the preset 2. However due to the mixing being done before the logarithmic control of the variable gain cell the ratio is only true in the top 30-40 dB range reverting to a ratio of 1 below this level. Both compressor and expander however follow the same curve and compensate for each other.

We have provided two release times in the unit. With a fast release time there is distortion created at low frequency while if it is too slow the unit appears to 'breathe'. The slow time is slow enough to give reasonable low distortion while minimising breathing. However the distortion created by a fast release time is compensated in the expansion mode provided it is recorded and played back at the same settings.

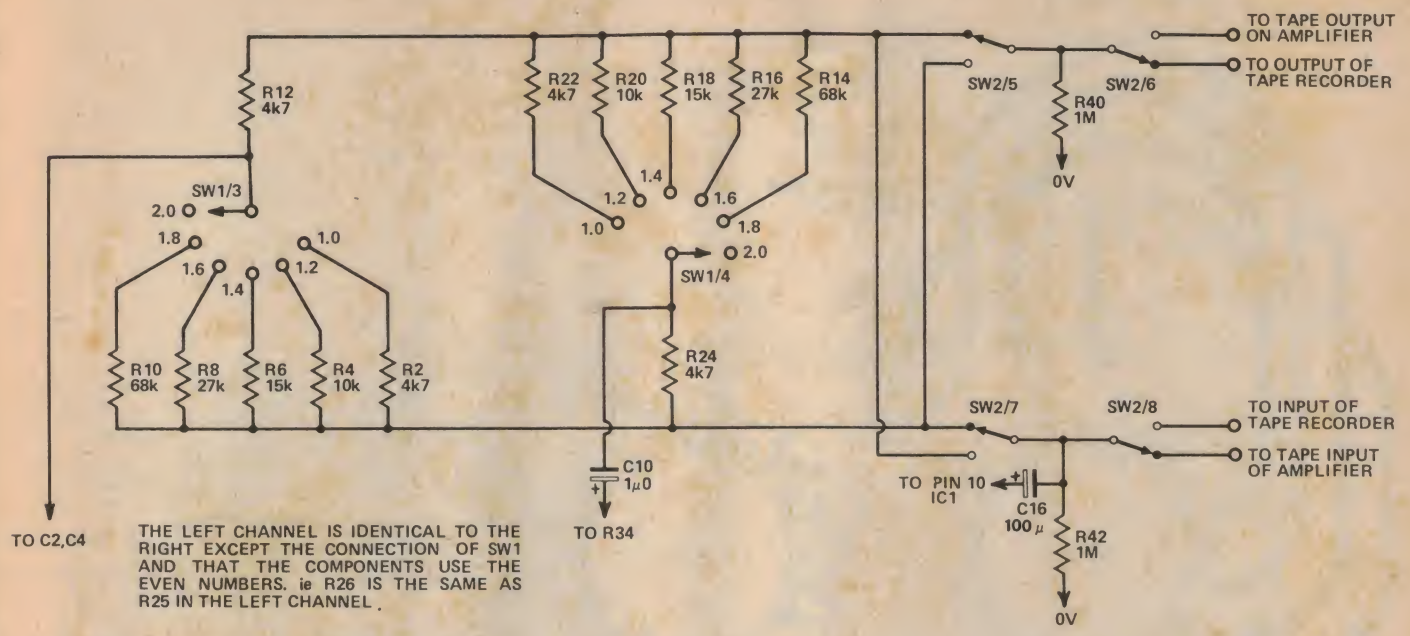


Fig. 2. Changes in the circuit for the left channel. The changes are only to simplify the PCB layout.

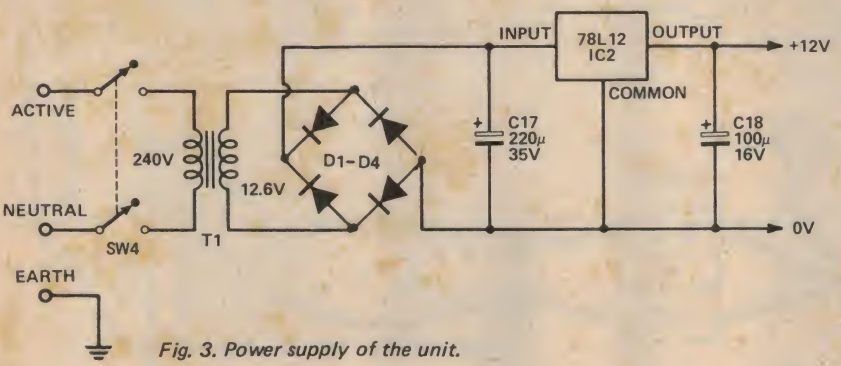
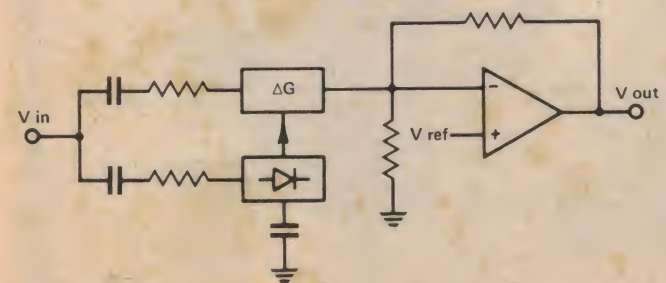


Fig. 3. Power supply of the unit.

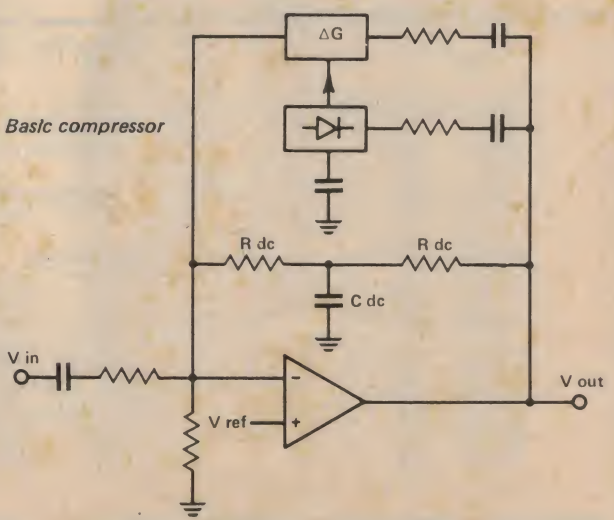
Expander or Compressor

These diagrams show how the IC is connected to operate as either a compressor or expander with a fixed ratio of 2.0.

Basic expander.



Basic compressor



Project 484

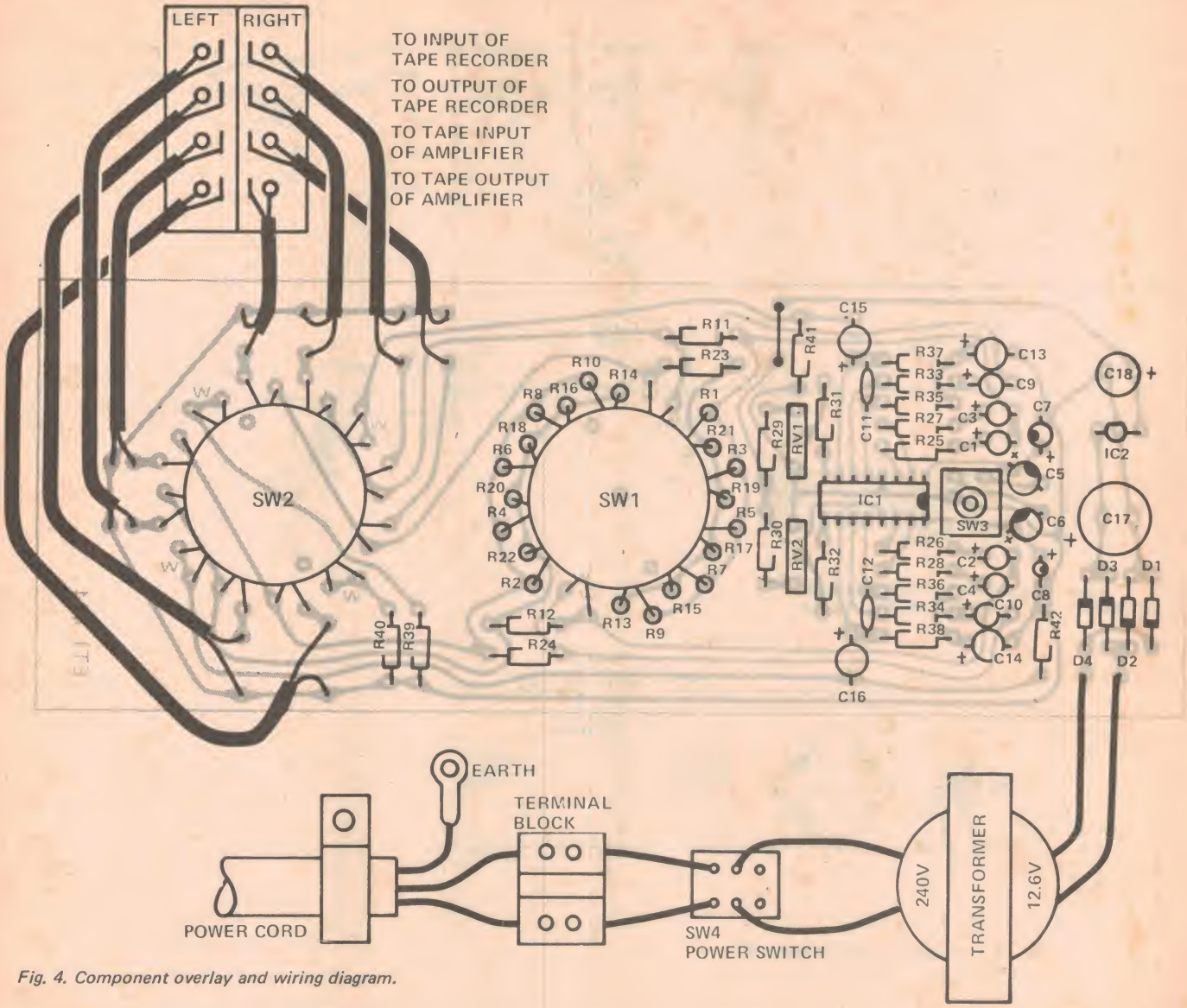


Fig. 4. Component overlay and wiring diagram.

PARTS LIST – ETI 484

Resistors all ½W 5%

R1,2	4k7
R3,4	10k
R5,6	15k
R7,8	27k
R9,10	68k
R11,12	4k7
R13,14	68k
R15,16	27k
R17,18	15k
R19,20	10k
R21,22	4k7
R23,24	4k7
R25,26	22k
R27,28	10k
R29,30	47k
R31,32	68k
R33,34	22k
R35-R38	33k
R39-R42	1M

Potentiometers

RV1,2	25 k trim

Capacitors

C1-C4	1μ0 50V electro
C5,6	6μ8 10V tantalum
C7,8	3μ3 10V tantalum
C9,10	1μ0 50V electro
C11,12	33p ceramic
C13.14	10μ 16V electro
C15,16	100μ 16V electro
C17	220μ 35V electro
C18	100μ 16V electro

Semiconductors

IC1	NE571
IC2	78 L 12
D1-D4	1N4001

Miscellaneous

PC board ETI 484
Transformer 240-12.6V 100mA
SW1 4 pole 6 position OAK switch (2 sec. 2 poles 6 pos.)
SW2 8 pole 2 position OAK switch (2 sec. 4 poles 2 pos.)
SW3,4 DPDT toggle
Two, four-way RCA sockets
Chassis, cover and front panel
3 core flex, plug and clamp

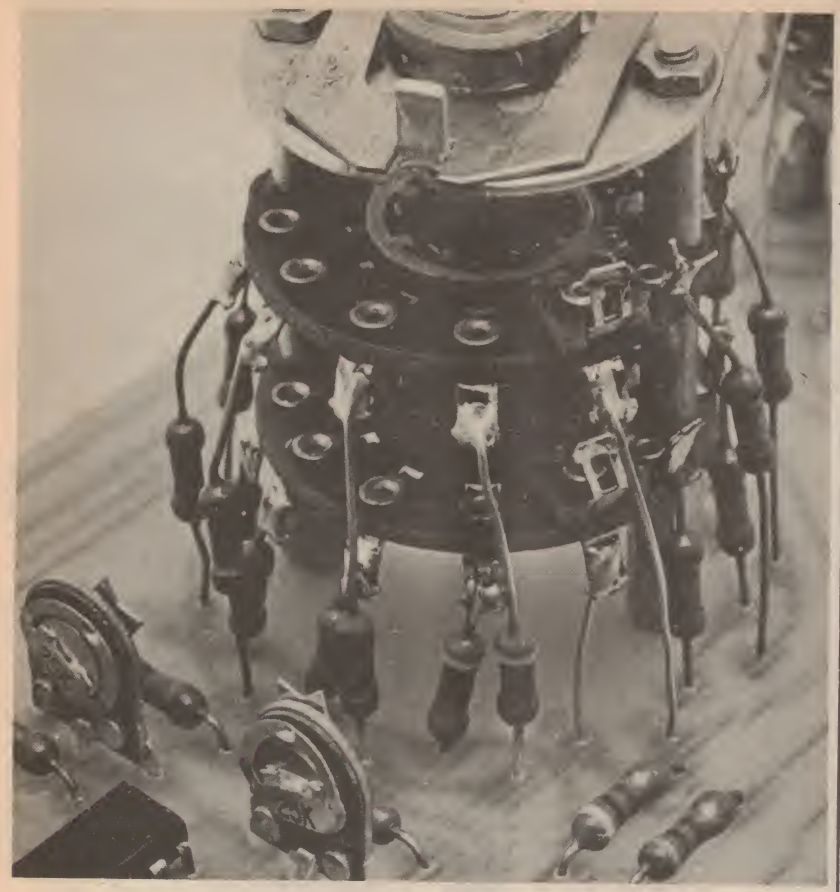
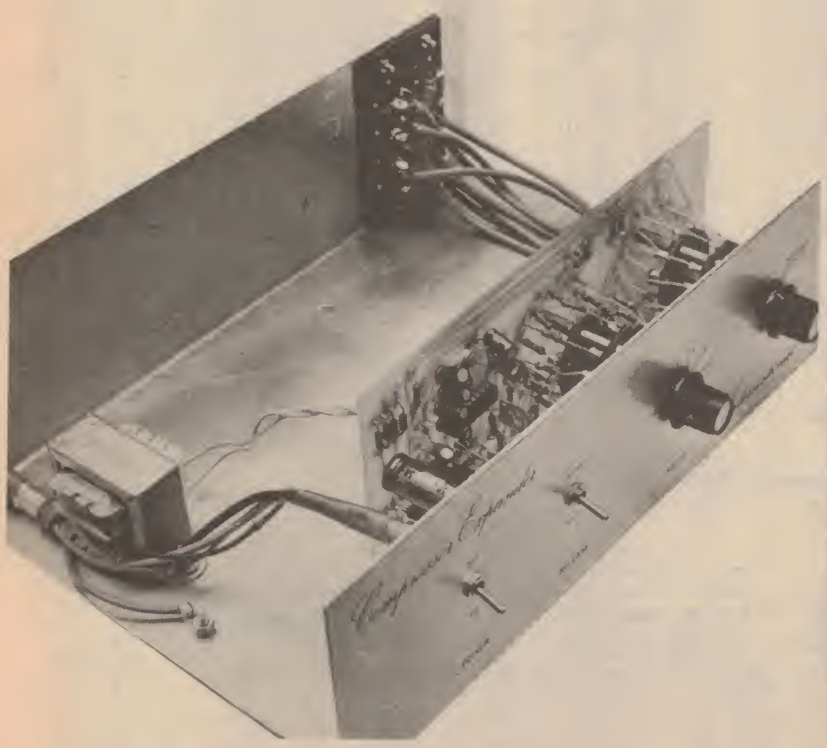


Photo showing how the resistors are connected to the rotary switch.



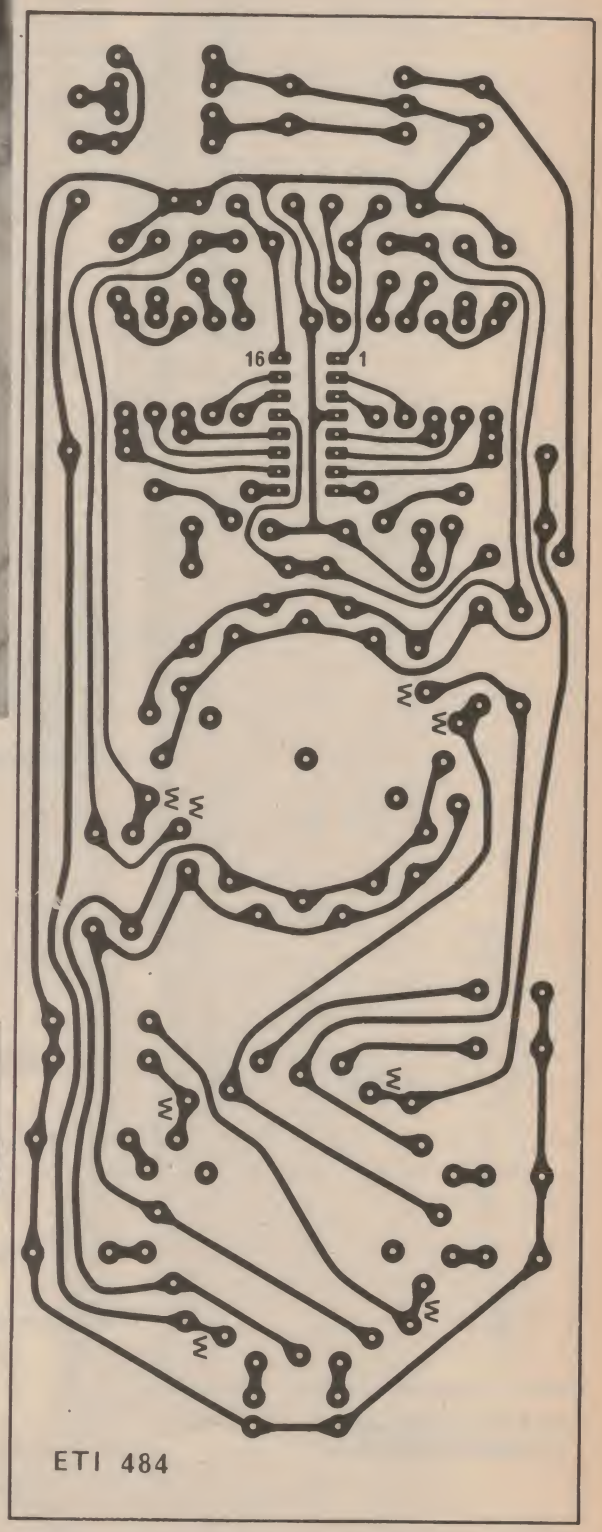


Fig. 5. Printed circuit layout. Full size 200 x 75 mm.

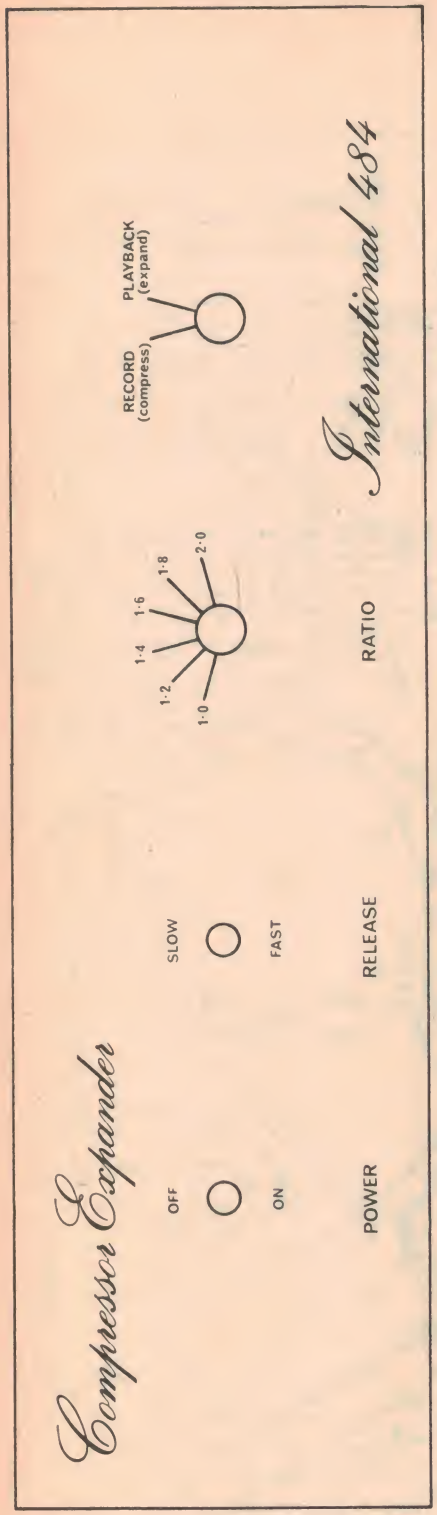


Fig. 6. Front panel artwork.
For dimensions see Fig. 9.

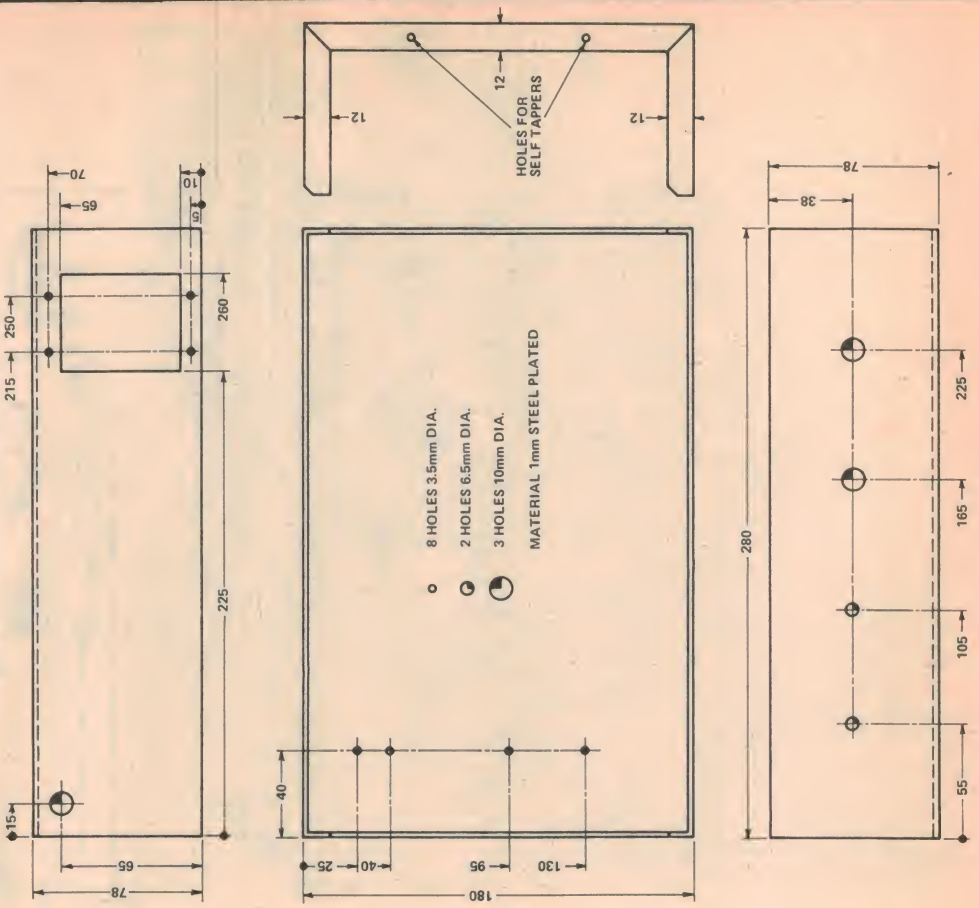


Fig. 7. Chassis details.

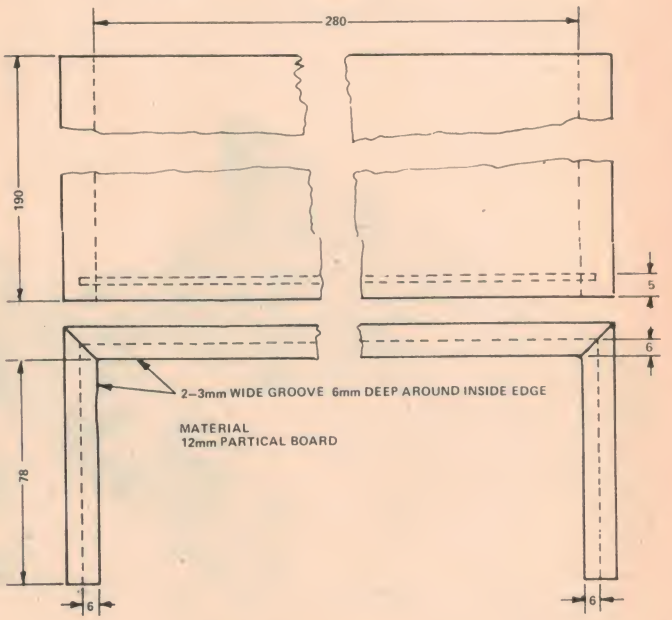


Fig. 8. Cover used on the unit.

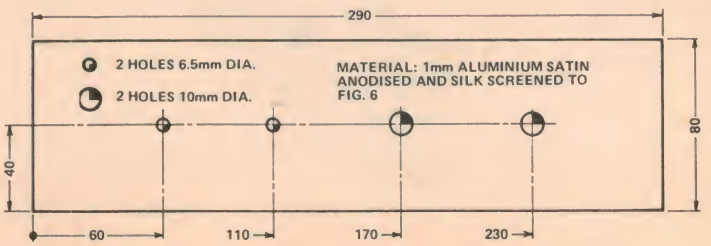


Fig. 9. Dimensions of the front panel.

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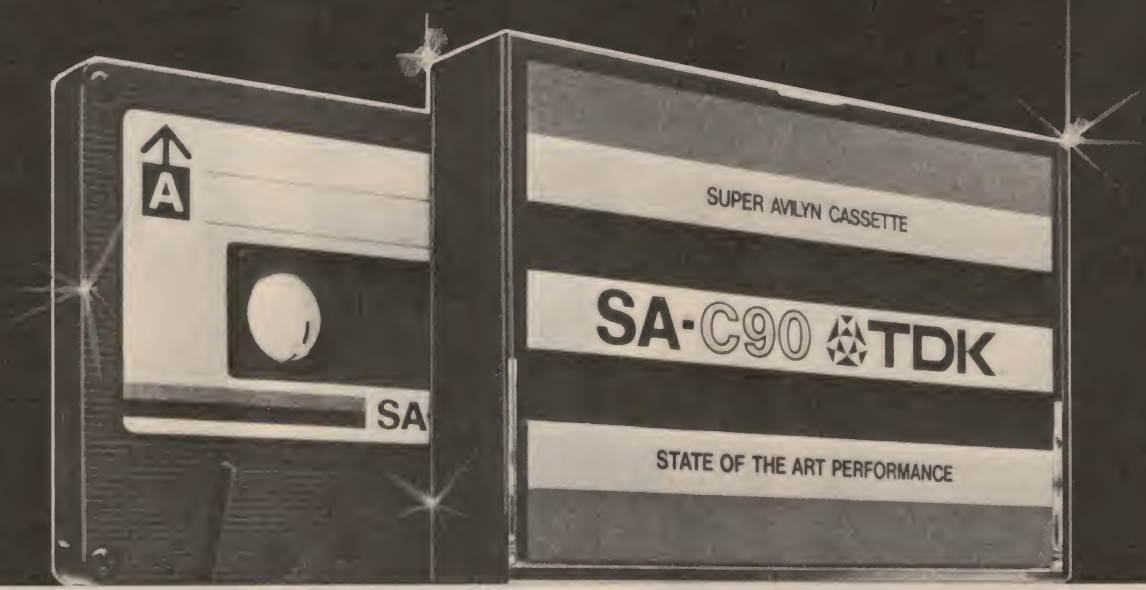

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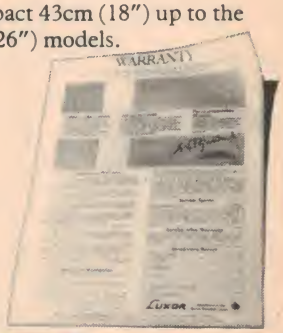

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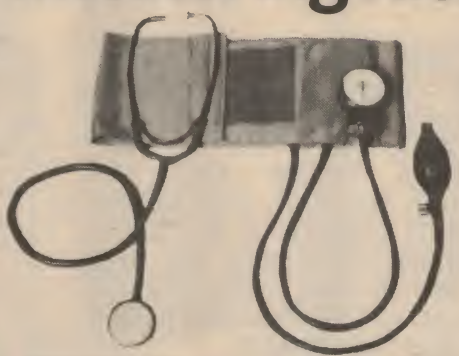

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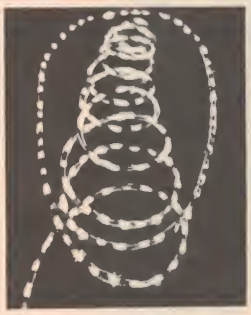

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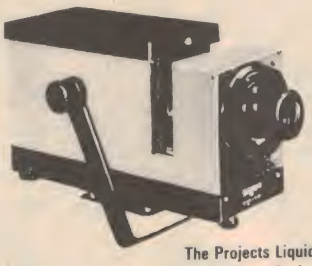

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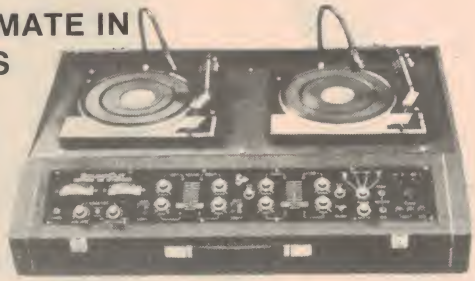

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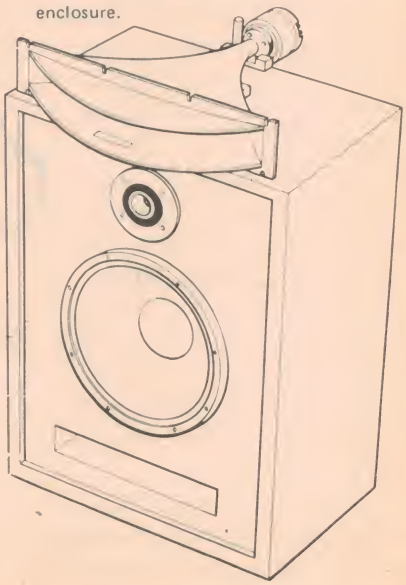
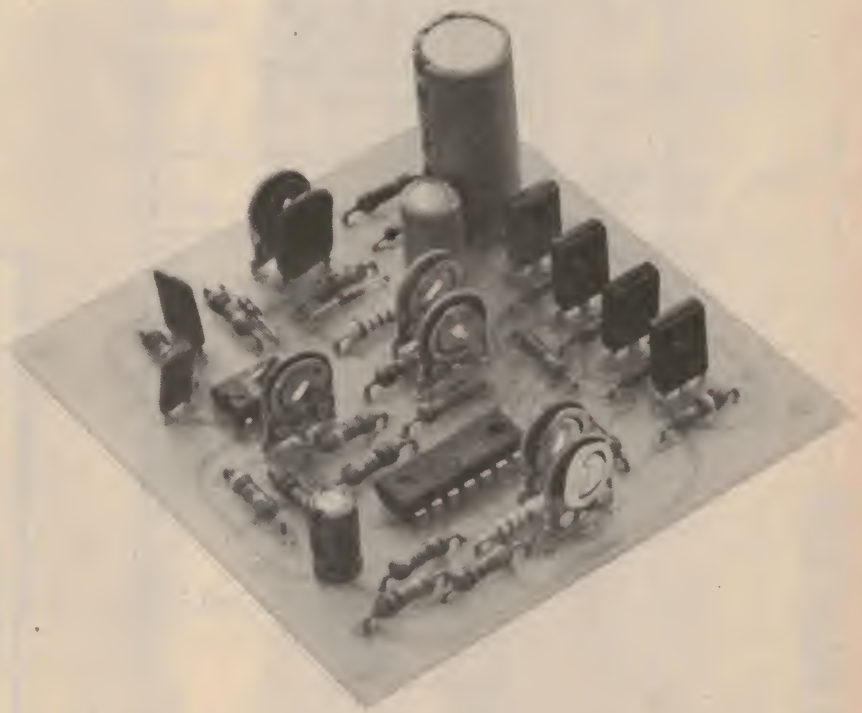


REV. MONITOR – COUNTER

This design uses lights to indicate the upper and lower limits of ideal rev ranges, and also includes an optional analogue tachometer.



WE HAVE HAD many requests to publish the design of a digital tachometer for use in cars. However, a couple of factors make this less than a practical proposition.

The most important drawback is difficulty of reading the digital display. Many cars can rev out over a 5000 rpm range in less than two seconds; even with 100 rpm resolution this would have the second digit changing every 0.04 seconds.

Additionally, the simplest design principle – counting the number of pulses from the distributor over a period of time – would not offer acceptable resolution for a reasonable sampling rate. On a four-cylinder car, a two-digit readout, i.e. 100 rpm resolution, calls for a sampling time of 0.3 sec, while 3 sec is needed for a three-digit readout.

Analogue meters are easier to read but may be a little sluggish with cars which can rev out quickly in first gear. We therefore decided to design an analogue tacho and add three indicator lamps to give an instant indication or warning of engine speed. One of these is on below a set rpm indicating that the motor is below the ideal minimum, a second which is on between certain limits indicating the working range of the engine and the third comes on above a set rpm indicating too high an engine speed. All the limits are adjustable and by overlapping the limits five bands of engine speed can be indicated.

Where the vehicle is already fitted with a tacho, or one is not wanted, the lights can be used by themselves. This reduces the cost considerably, while the lights still give an indication of engine speeds and when to change gear.

Construction

The electronics can be assembled on the printed circuit board with the aid of the overlay in Fig 3. Due to the number of components, the use of the printed circuit board is recommended. The value of R4 should be selected from Table 1.

The mechanical arrangment for the lights and meter we have left to the constructor as variations in style required make it difficult to give any details.

Adjustment

The potentiometer RV1 should be adjusted to give stable readings over the entire rpm range. Calibration of the meter is done by RV2 and this should be done against a known instrument. The lights are adjusted by RV3, RV6, RV4 and RV5 (from the lowest to the highest limit) to whatever levels are required.

REV. MONITOR – COUNTER

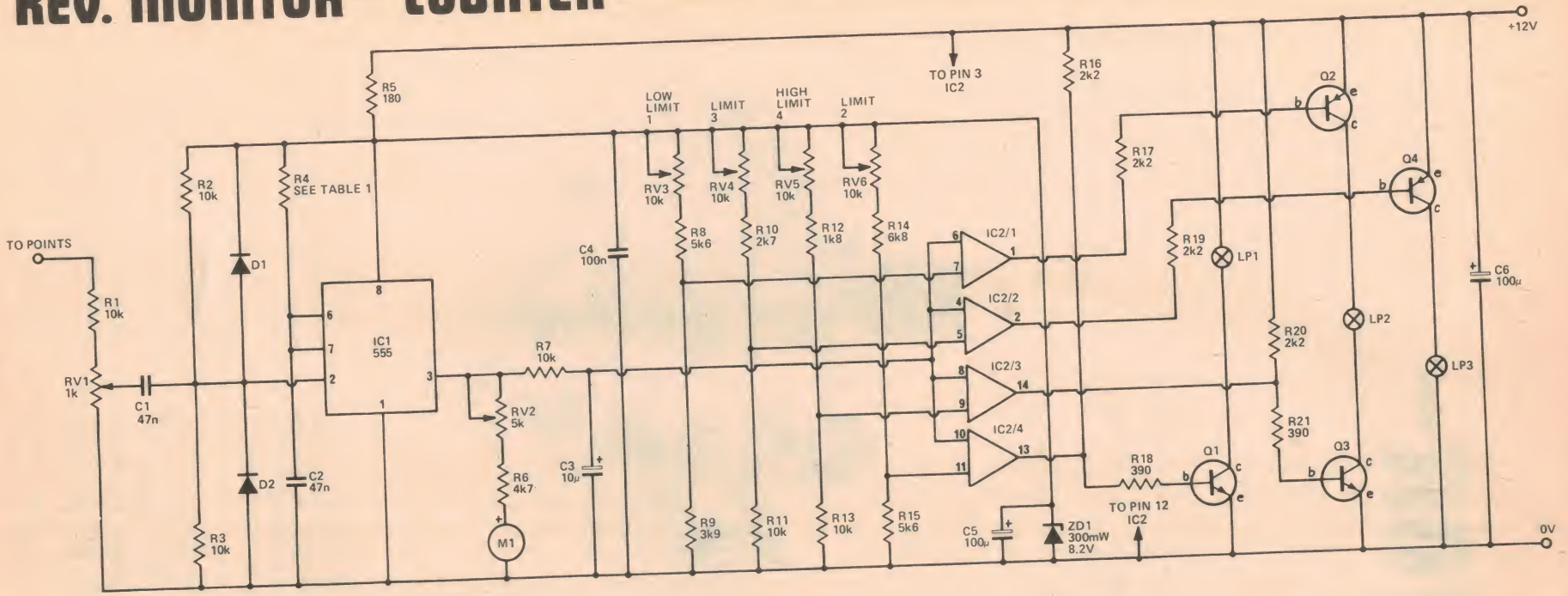


Fig. 1. Circuit diagram of the rev. monitor - counter.

How It Works – ETI 317

The pulses from the spark coil are used to trigger a 555 timer IC1. This is connected as a monostable where the pulse width is 1.1 x R4 x C2 seconds. Pin 2 is normally at about 4 volts and the input pulse causes this to drop to less than the 2.7V trigger point. The supply voltage for this IC is regulated to 8.2V by ZD1. The output of this IC is a positive pulse on pin 3 and this is used to drive the meter to give a readout of rpm.

The output is also filtered by R7 and C3 to give an output voltage which is proportional to rpm. IC2 is a quad comparator which compares this voltage with four preset levels. If the input voltage is lower than the set level the output of the comparator will high. The output of the LM339 is an open collector transistor and can only sink current and therefore appears as an open circuit when high.

The outputs of IC2 control the transistors Q1 to Q4 which handle the current required by the lamps. If the rpm is below the lower limit Q1 and Q3 will be on lighting LP1 but as Q2 is off LP2 will be off. Above the first limit Q2 will be turned on and so LP2. Above the next limit Q1 and LP1 will turn off, above the next Q4 and LP3 will turn on, and finally when the upper limit is reached Q3 will turn off LP2 leaving only LP3 on.

Fig. 2. Printed circuit layout. Full size 80 x 75 mm.

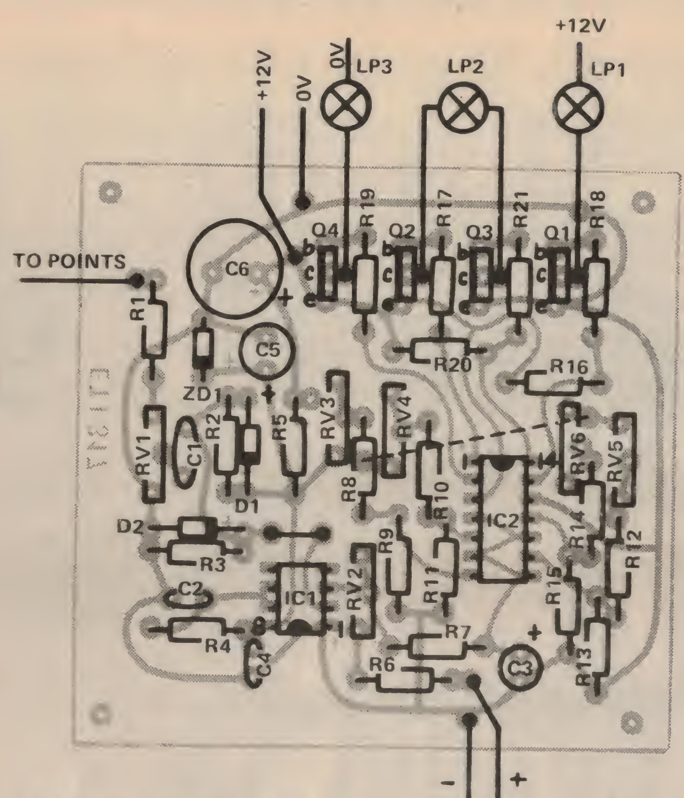


Fig. 3. Component overlay. Note the link between RV4 and RV6. This link is on the copper side of the pc board.

PARTS LIST – ETI 317

Resistors all ½W 5%

R1–R3	10k
R4	see table 1
R5	180
R6	4k7 *
R7	10k
R8	5k6
R9	3k9
R10	2k7
R11	10k
R12	1k8
R13	10k
R14	6k8
R15	5k6
R16,17	2k2
R18	390
R19,20	2k2
R21	390

Potentiometers

RV1	1k trim
RV2	5k trim *
RV3–RV6	10k trim

Capacitors

C1,2	47n polyester
C3	10μ 16V electro
C4	100n disc ceramic
C5	100μ 16V electro
C6	100μ 25V electro

Semiconductors

IC1	555
IC2	LM339
Q1	BD139
Q2	BD140
Q3	BD139
Q4	BD140
D1,2	1N914
ZD1	8.2V 300mW

Miscellaneous

PC board ETI 317
LP1–LP3 12V lamps (max. 250mA)
Meter 1mA FSD *

* Delete if tacho is not needed.

TABLE 1

Value of R4	Number of cylinders		
Max. RPM	4	6	8
5000	100k	68k	47k
6000	82k	56k	39k
7000	68k	56k	39k
8000	68k	39k	33k

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Model 1

Speaker Components:
8″ bass driver low frequency
4″ cone driver high frequency

Operational power:
12 watts to 75 watts

Cabinet finish:
Hand rubbed oiled oak

Model 3

Speaker Components:
10″ bass driver low frequency
4″ high frequency

Operational power:
10 watts to 100 watts

Cabinet finish:
Vented enclosure, hand-rubbed oiled oak with acoustically transparent black knit fabric.

Model 5

Speaker Components:
2 each 4″ frame cone drives high frequency
12″ bass driver low frequency

Operational power:
12 watts to 150 watts

Cabinet finish:
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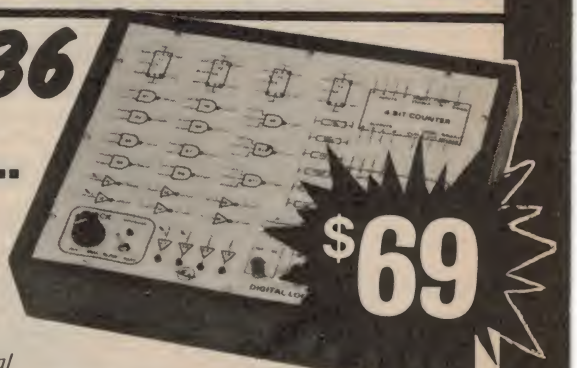

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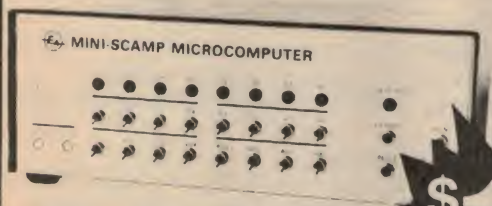

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22uF	7c	8c	9c	11c
33uF	8c	9c	10c	13c
47uF	9c	10c	11c	14c
100uF	11c	12c	13c	17c
220uF	13c	17c	15c	20c
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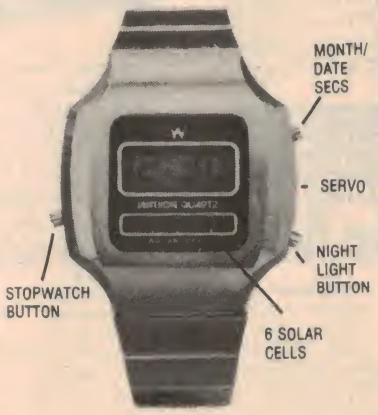

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3.3 µFd	25 p.c.b.	10c	8c
4.7 µFd	10 p.c.b.	10c	8c
4.7 µFd	25 p.c.b.	10c	8c
22 µFd	10 p.c.b.	10c	8c
22 µFd	50 p.c.b.	17c	15c
25 µFd	16 p.c.b.	10c	8c
33 µFd	6.3 p.c.b.	11c	9c
33 µFd	16 p.c.b.	12c	10c
47 µFd	10 p.c.b.	14c	12c
47 µFd	25 p.c.b.	16c	14c
47 µFd	50 p.c.b.	17c	15c
100 µFd	10 p.c.b.	16c	13c
100 µFd	25 p.c.b.	18c	15c
220 µFd	6.3 Axial	20c	17c
220 µFd	16 p.c.b.	20c	17c
220 µFd	35 p.c.b.	26c	22c
470 µFd	6.3 Axial	25c	22c
470 µFd	25 p.c.b.	25c	22c
			10 up
1000 µFd	10 Axial	38c	35c
1000 µFd	16 p.c.b.	40c	36c
1000 µFd	25 p.c.b.	52c	47c
1000 µFd	35 p.c.b.	52c	47c
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7404	40c	35c
7408	40c	35c
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7420	40c	35c
7430	40c	35c
7447	$1.50	$1.40
7451	40c	35c
7454	40c	35c
7474	90c	85c
7490	80c	75c
7492	80c	75c
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C/MOS

	1 off	10 up
4000	40	35
4001	40	35
4002	40	35
4006	2-50	2-25
4007	40	35
4008	2-75	2-50
4009	80	70
4011	45	40
4012	40	35
4013	1-00	90
4014	2-25	2-05
4016	85	75
4017	2-25	2-05
4018	2-50	2-25
4021	2-30	2-10
4022A	1-90	1-70
4023A	45	40
4024	1-35	1-20
4027A	1-00	90
4028A	1-90	1-70
4030A	80	70

LINEAR

	1 off	10 up
LM301	70	60
LM304	1-30	1-20
LM305	1-20	1-10
LM307	70	60
LM308	2-30	2-10
LM309K	2-80	2-60
LM319	2-80	2-60
LM324	3-20	3-00
LM339	3-20	3-00
LM377	2-80	2-50
LM380	1-50	1-35
LM382	2-45	2-30
LM3900	1-50	1-25
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LM709	45	40
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LM741	45	40
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WITH the noise pollution laws now in force it is illegal to allow an alarm which has any reasonable volume to ring continuously. It must be reset after ten minutes or so and this leads to a problem. Most alarms work on a system where all the windows and doors have normally closed reed switches which are all wired in series so that the opening of a window or door breaks the loop, setting off the alarm. The alarm then rings for ten minutes and resets. However, if the window is still open, i.e., no-one is home to close it, the alarm must be switched off completely to prevent it continuing to ring.

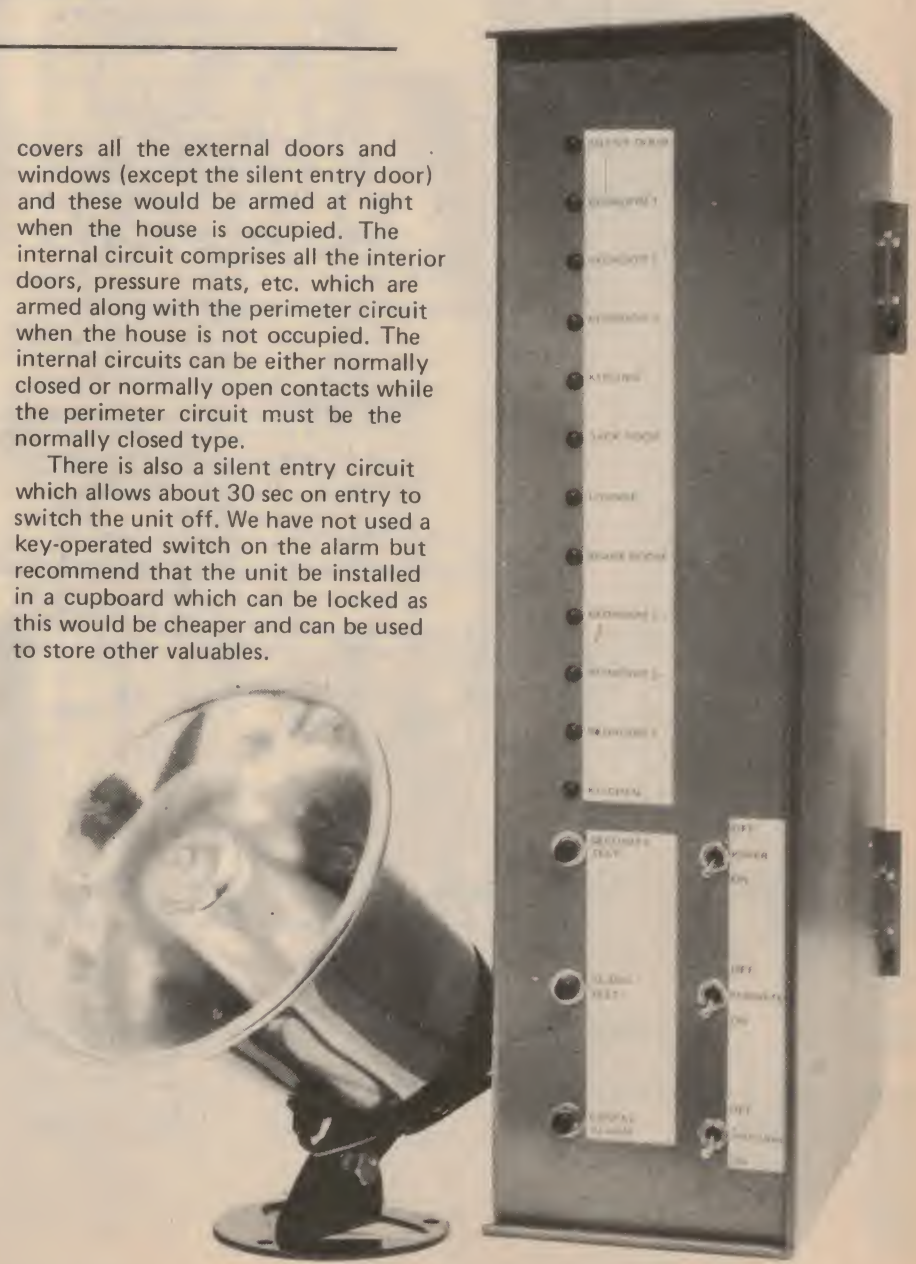
It is for this reason we have not published a reset circuit for the alarms we have described previously, although it has often been requested.

We therefore designed a completely new alarm which does not use a single loop but each window or group of windows in the same room has its own circuit. The alarm is not triggered when the window is continually open, but is triggered by the change of state of the sensor when the window is opened, so that the open window will be ignored when the alarm is reset, but leaving all other doors, windows, floor mats, etc. active. This affords some protection to the house if the alarm has been triggered and reset automatically.

We have provided a test button so that a check on the security of the house can be made before the alarm is set indicating immediately which window is open.

We have separated the alarm into two main sections, a perimeter circuit and an internal circuit. The perimeter circuit covers all the external doors and windows (except the silent entry door) and these would be armed at night when the house is occupied. The internal circuit comprises all the interior doors, pressure mats, etc. which are armed along with the perimeter circuit when the house is not occupied. The internal circuits can be either normally closed or normally open contacts while the perimeter circuit must be the normally closed type.

There is also a silent entry circuit which allows about 30 sec on entry to switch the unit off. We have not used a key-operated switch on the alarm but recommend that the unit be installed in a cupboard which can be locked as this would be cheaper and can be used to store other valuables.



HOUSE ALARM

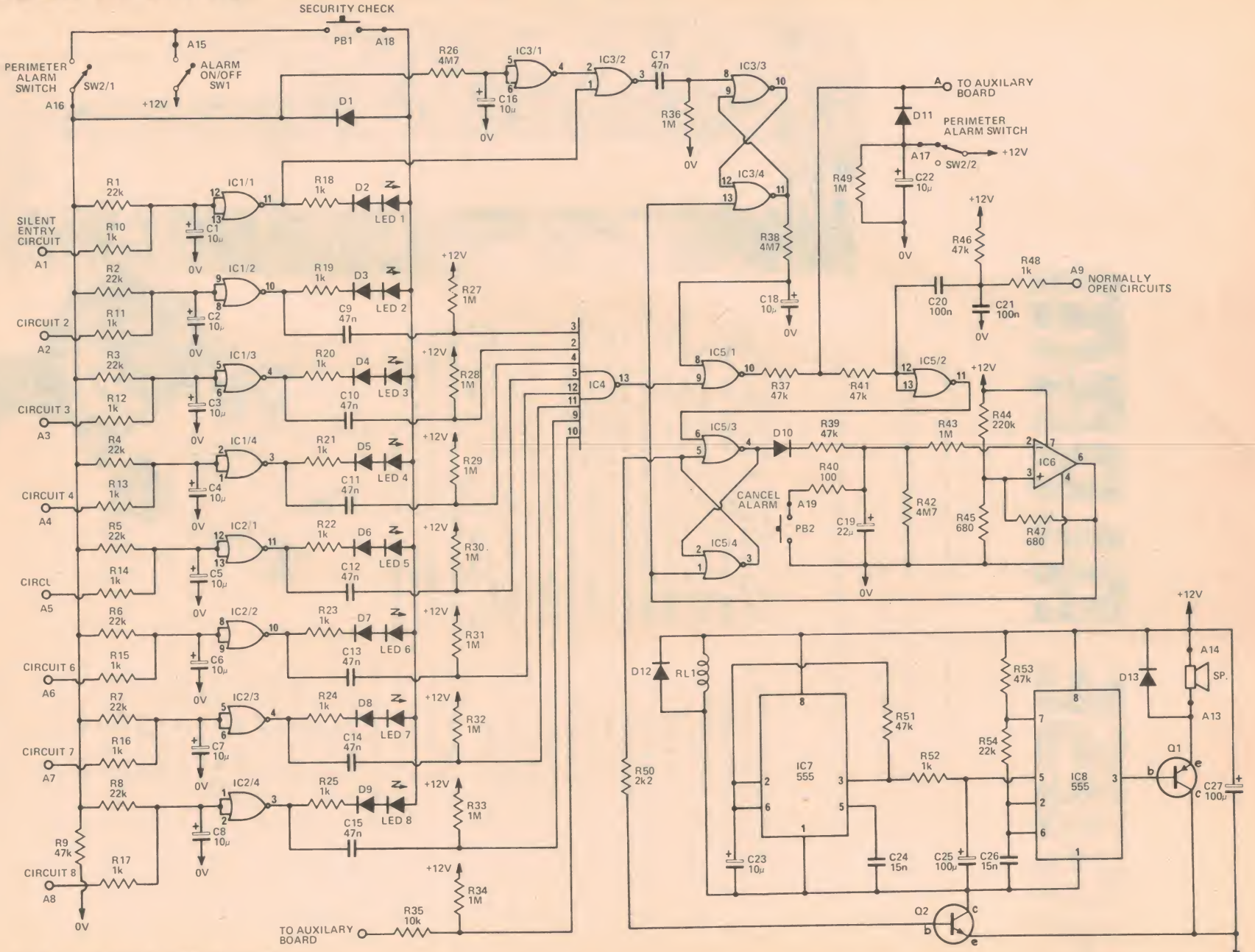


Fig. 1. Circuit diagram of the 'A' board.

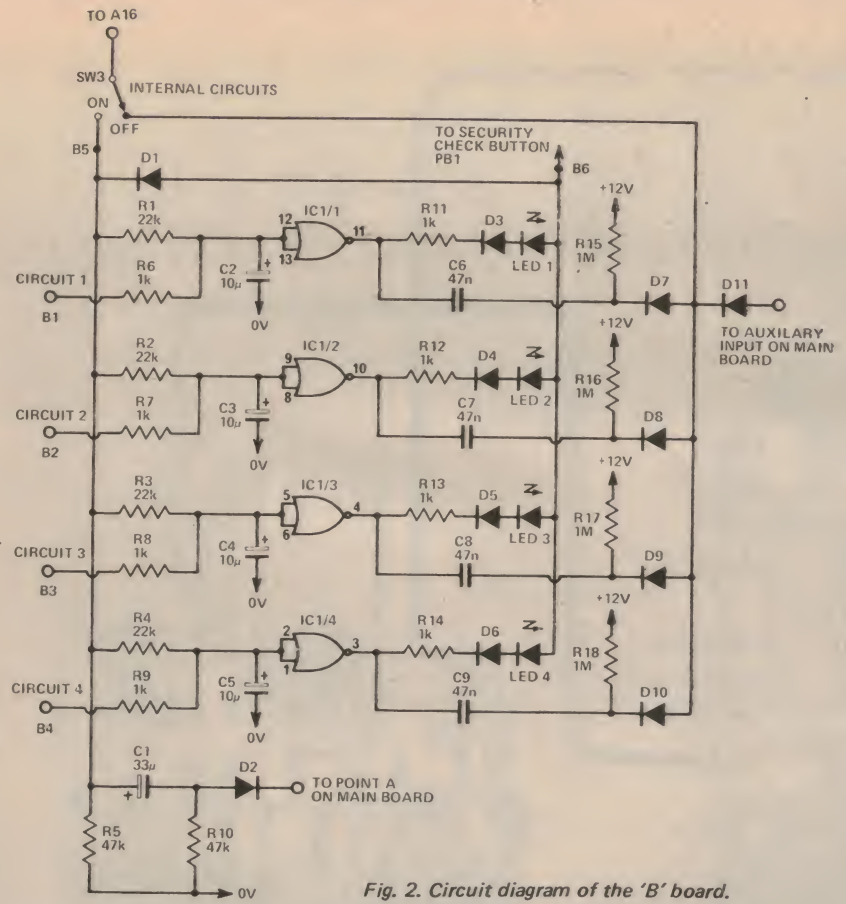


Fig. 2. Circuit diagram of the 'B' board.

CIRCUIT A
IC1–IC3 ARE 4001
IC4 IS A 4068
IC5 IS A 4001
IC6 IS A CA3130
IC7,8 ARE NE555
THE POWER RAILS OF IC1–IC5 ARE NOT SHOWN. PIN 7 IS 0V, PIN 14 IS +12V.
Q1 IS A TIP 2955
Q2 IS A BC 549
D1–D11 IN914
D12,D13 IN4001

CIRCUIT B
IC1 IS A 4001
D1–D11 ARE IN914

Construction

Due to the number of components, it is recommended that the unit should only be built using the PC boards shown here.

Assemble the components, watching the connection of all the polarised components. Also solder the CMOS ICs last and then solder pins 7 and 14 first. This allows the protection diodes inside the IC to be effective. The LEDs should be mounted parallel to the PC board as shown in the overlay as these have to protrude through holes in the chassis.

In the prototype we used both a relay and a siren circuit while in use only one should be required. Therefore simply leave out the unwanted components.

We mounted the unit in a metal box (actually it was a blank chassis for a 440 amplifier) as shown in the photos. We have not given mechanical drawings however.

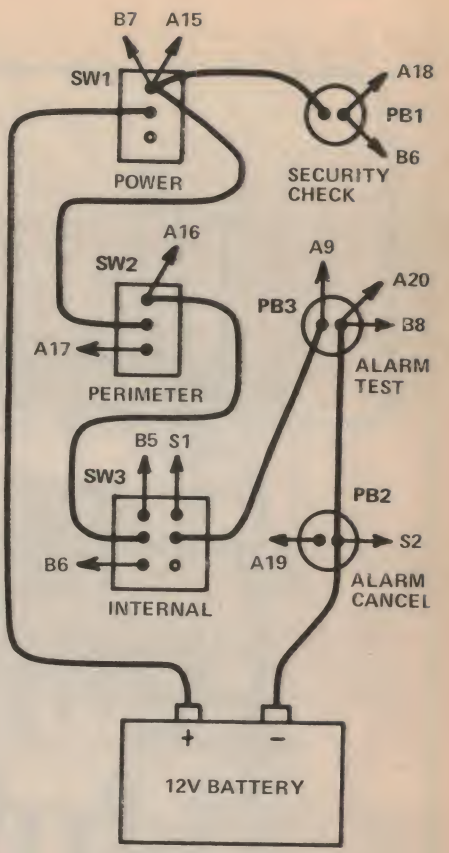


Fig. 3. Wiring of the switching and pushbuttons.

How It Works – ETI 582

Unlike normal alarms which use a single loop around the complete house with all the switches in series, with this alarm each door or window or a group of windows in the same room, uses its own circuit. IC1 and IC2 are used to detect an open window and if so the output of the IC associated with that circuit will be low. Capacitors C1–C8 and resistors R10–R17 provide a slight delay to prevent accidental triggering due to lightning etc. In each output of IC1 and IC2 there is a LED which is connected when the security button is pressed indicating which windows are open. This will allow them to be closed before the alarm is activated.

The normal circuits (ie not the silent entry one) have an RC network to generate a negative pulse if a window is opened and these are connected to one of the eight inputs of IC4. If a window is opened the resultant pulse at the input of IC4 will cause a positive pulse at its output.

With the silent entry door a 30 sec delay due to R26, C16 and IC3/1 overrides the output of IC1/1 immediately after the alarm has been activated allowing time to leave the house. After that time if the door is opened the output of IC3/2 will go high and the pulse generated by C17 and R36 will toggle the RS flip flop formed by IC3/3 and IC3/4. After another 30 sec. the input to IC5/1 will be high and its output will go low. The same output occurs if one of the normal inputs is triggered due to the output of IC4 going high.

The RS flip flop IC5/3 and IC5/4 is toggled by this pulse and this controls two circuits. These are a 5 minute delay for resetting and the alarm circuitry.

The delay circuitry uses a CA3130 IC where C19 is normally charged to +10 volts until the flip flop is triggered allowing it to discharge via R42. When the voltage has fallen to about 20 mV the output of the IC will go high, resetting both of the RS flip flops.

The output device can be either a relay or a siren circuit. In this circuit we have used two 555 timers, one operating at a high frequency and driving the speaker via the buffer transistor Q1 and the other at about 2 Hz which is used to modulate the frequency of IC8. If the capacitor C25 is deleted the result is a hee-haw type of alarm.

If more than seven normal circuits or if internal circuits are required they can be added in modules of four at a time and are connected to the eighth input of IC4. For emergency inputs ie fire alarms, or alarm devices using normally open contacts, a separate input to IC5/2 is provided. The emergency circuits will operate the alarm even if the normal circuits are not switched on.

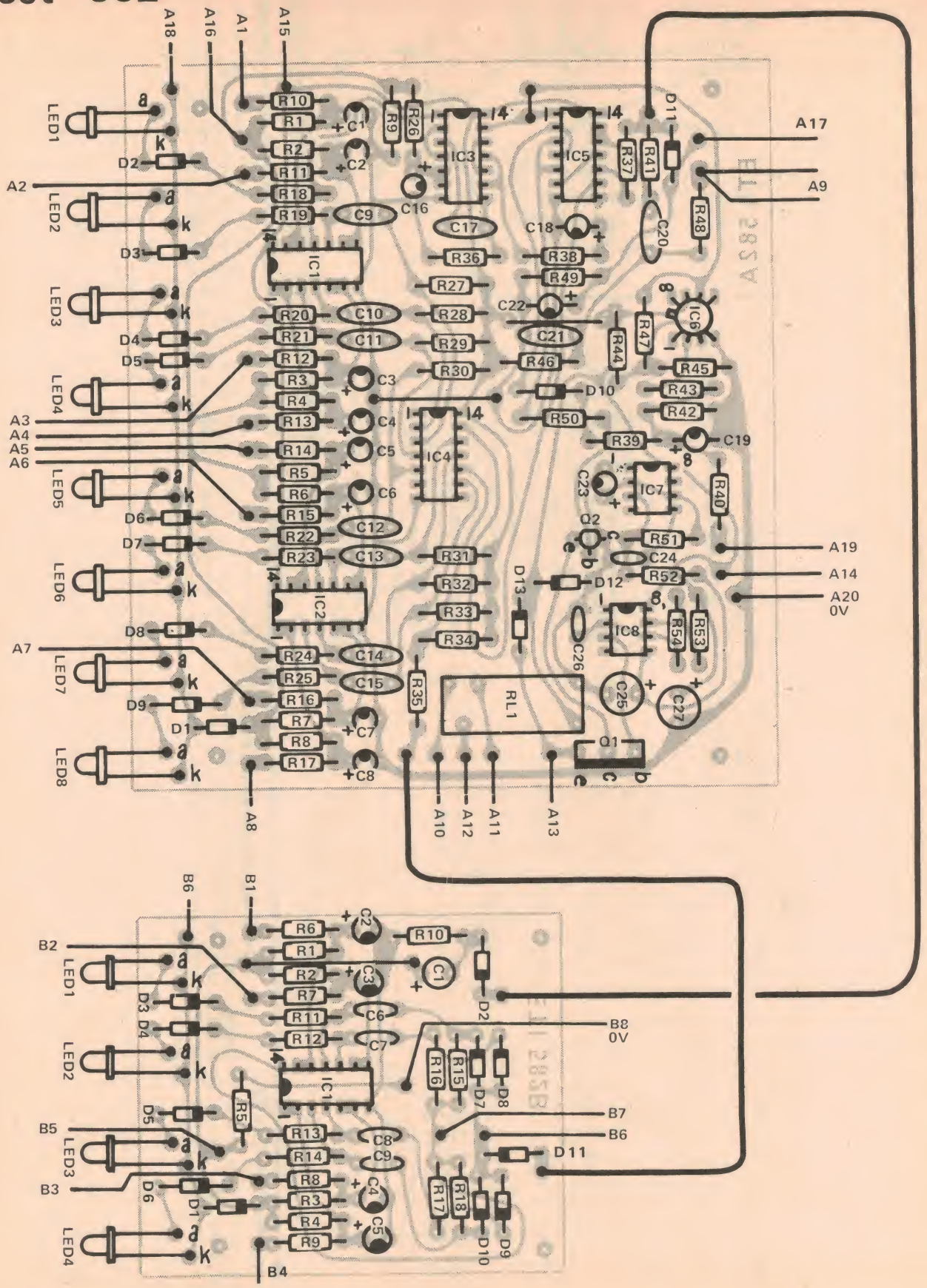


Fig. 4. Component overlay and interwiring of the two boards.

PARTS LIST – ETI 582A

Resistors all ½W 5%

R1–R8	22k
R9	47k
R10–R25	1k
R26	4M7
R27–R34	1M
R35	10k
R36	1M
R37	47k
R38	4M7
R39	47k
R40	100
R41	47k
R42	4M7
R43	1M
R44	220k
R45	680
R46	47k
R47	680
R48	1k
R49	1M
R50	2k2
R51	47k
R52	1k
R53	47k
R54	22k

Capacitors

C1–C8	10µ 16V tantalum
C9–C15	47n polyester
C16	10µ 16V tantalum
C17	47n polyester
C18	10µ 16V tantalum
C19	22µ 16V tantalum
C20,21	100n polyester
C22,23	10µ 16V tantalum
C24	15n polyester
C25	100µ 16V electro
C26	15n polyester
C27	100µ 16V electro

Semiconductors

IC1–IC3	4001 (CMOS)
IC4	4068 (CMOS)
IC5	4001 (CMOS)
IC6	CA3130
IC7,8	555
Q1	TIP 2955
Q2	BC549
D1–D11	1N914
D12,13	1N4001

LED1–8 Light emitting diodes

Miscellaneous
PC board ETI 582A
RL1 12V relay 280 ohm coil

PARTS LIST – ETI 582B

Resistors all ½W 5%

R1–R4	22k
R5	47k
R6–R9	1k
R10	47k
R11–R14	1k
R15–R18	1M

Capacitors

C1	33µ 16V electro
C2–C5	10µ 16Vtantalum
C6–C9	47n polyester

Semiconductors

IC1	4001 (CMOS)
D1–D11	1N914
LED1–4	Light emitting diodes

Miscellaneous
PC board ETI 582B

ETI 582 – GENERAL

SW1,2 single pole toggle switch
SW3 double pole toggle switch
PB1–PB3 press to make push buttons
Case to suit
12V battery type 732 or similar
Terminal strips

SPECIFICATION – ETI 582

Types of inputs	Silent entry Perimeter circuts Internal circuits Emergency circuits
Silent entry	Single circuit, 30 s exit delay, 30 s entry delay.
Perimeter circuits	7 circuits, N/C contacts, can be expanded in units of 4.
Internal circuits	4 circuits, N/C contacts, can be expanded in units of 4. Any number of N/O circuits.
Emergency circuits	Any number of N/O circuits. These circuits are active even if perimeter and internal circuits are switched off.
Current drain and battery life (type 732)	
Emergency only	2.5 mA (4000 hours)
Alarm active	9 mA (2000 hours)
Alarm sounding	500 mA (10 hours)
Alarm time	12 minutes

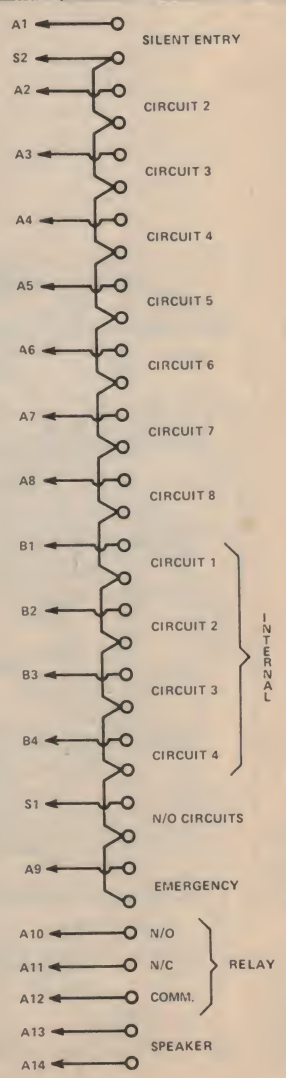


Fig. 5. Connection of the rear terminal blocks.

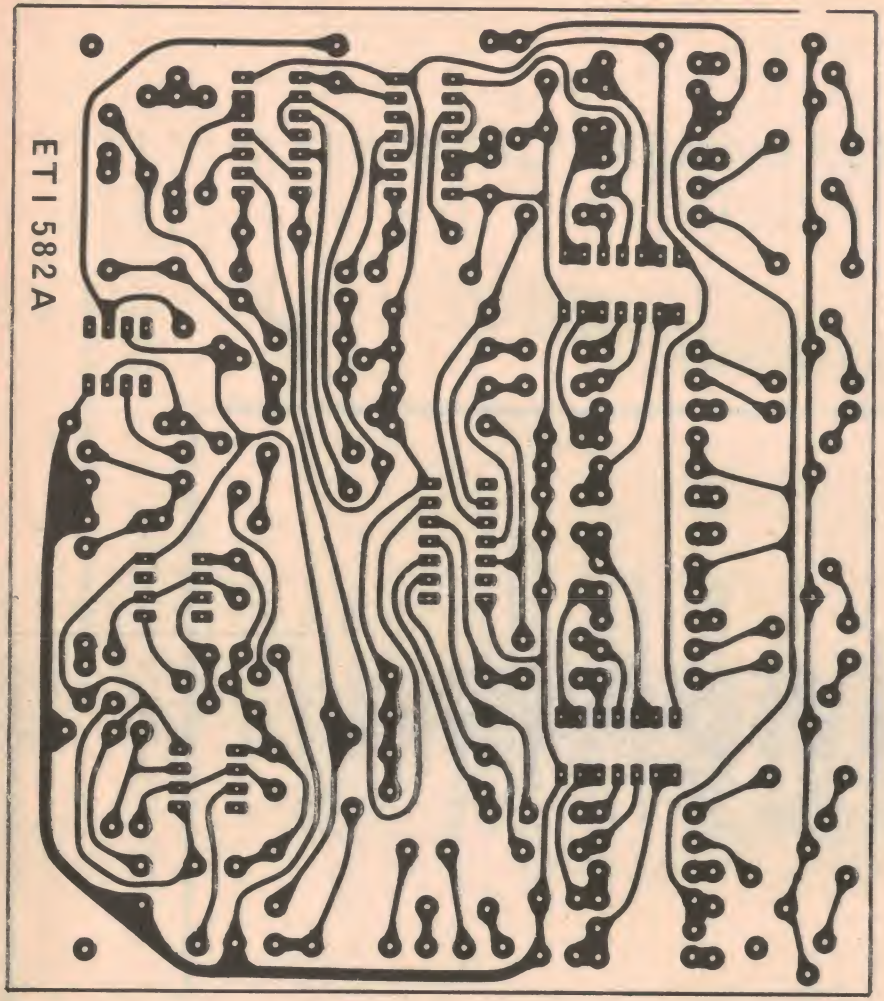


Fig. 7. PC board layout of board 'A'. Full size 130 x 115 mm.

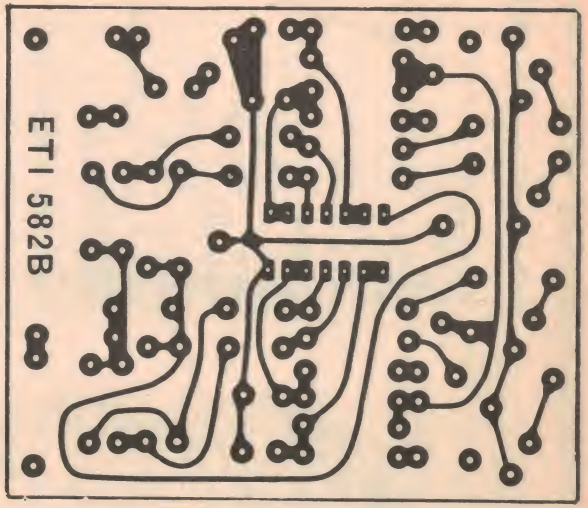
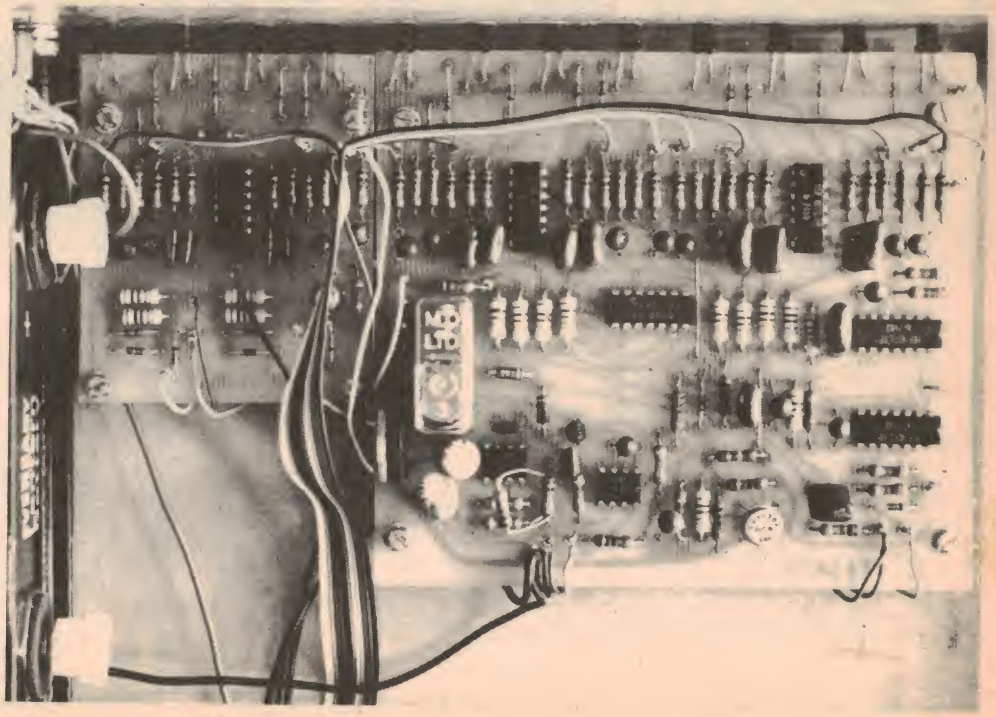


Fig. 6. PC board layout of board 'B'. Full size 75 x 65 mm.



NEXT MONTH we will give full details of how to install the alarm and how to take full advantage of its capabilities. In addition we will give hints on other ways to make your home completely burglar proof, including the various sensors that are available and such commonsense precautions as locks for doors and windows.

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2. ± 12V POWER SUPPLY
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- −12V @ 250mA
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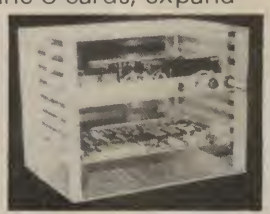

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CA3013	5 80	CD4071	55	LM379	7 50	SL623C	17 40	7400	48
CA3018	3 50	CD4072	55	LM380N	2 75	SL624C	8 80	7401	48
CA3023	6 80	CD4075	55	LM381N	3 20	SL630C	6 90	7402	48
CA3028A	2 60	CD4076	1 25	LM382N	2 60	SL640C	10 60	7403	48
CA3035	5 20	CD4078	55	LM387N	2 75	SL641C	10 60	7404	48
CA3039	2 10	CD4081	55	LM395K	6 90	SL645C	12 60	7405	48
CA3046	LM3046	CD4082	55	LM555CN	1 20	SL901B	3 90	7406	1 09
CA3053	1 70	CD4085	1 65	LM555H	1 95	SL917B	6 50	7407	1 09
CA3059	8 40	CD4086	1 65	LM556N	2 95	SL1310	1 60	7408	1 09
CA3060	8 40	CD4093	1 80	LM562B	10 90	SL3046	1 20	7409	48
CA3079	4 40	CD4502	2 70	LM565N	3 50	SP8505	8 60	7410	48
CA3080	2 10	CD4503	1 40	LM566CN	2 50	SP8515	12 90	7411	54
CA3081	2 70	CD4510	3 20	LM567CN	3 50	TAA300	2 90	7413	1 15
CA3082	2 70	CD4511	3 30	LM709N	95	TBA750	2 90	7414	2 70
CA3083	2 90	CD4514	6 50	LM710CN	1 25	TBA700	4 90	7416	1 00
CA3086	LM3086	CD4515	6 50	LM710CH		TBA810A	4 90	7417	1 15
CA3089E	2 90	CD4516	3 20	LM723H	1 70	TB1750A	3 90	7420	48
CA3090Q	6 90	CD4518	2 85	LM723N	1 25	TCA220	2 25	7422	1 95
CA3091	18 00	CD4519	1 35	LM725N	5 90	TCA290A	4 90	7425	95
CA3120E	4 50	CD4520	2 55	LM733CH	2 70	TCA420A	4 90	7426	70
CA3127E	4 50	CD4528	1 80	LM733N	2 50	TCA580	6 50	7427	66
CA3128E	9 90	CD4539	1 98	LM741CH	1 20	TCA730	6 90	7430	48
CA3130T	2 25	CD4555	1 80	LM741CN	75	TCA740	6 80	7432	66
CA3140T	2 25	CD4556	1 80	LM747CH	2 70	TDA1005	5 50	7437	90
CA3600	3 30	CD4720	12 60	LM747CN	2 50	UAA170	3 25	7438	90
CD4000	55	CD4724	3 85	LM748CN	1 20	UAA180	3 25	7440	48
CD4001	55	CD40097	1 80	LM1303N	2 60	UA723C	LM723	7441	2 80
CD4002	55	CD40098	1 80	LM1310N	3 50	UA757	3 80	7442	2 60
CD4006	2 30	CD40174	2 90	LM1458N	2 50	ULN2208	2 45	7445	2 60
CD4007	55	CD40175	2 90	LM1488N	6 90	ULN2209	2 45	7446	2 60
CD4008	2 35	CD40192	2 90	LM1489N	5 75	ULN2111	2 10	7447	2 60
CD4009	1 50	CD40194	2 90	LM1496N	1 90	74C00	55	7448	2 60
CD4010	1 50	CD40195	2 90	LM1808N	3 90	74C02	80	7450	48
CD4011	55	DM8097	1 90	LM3028	CA3028	74C04	55	7451	48
CD4012	55	HEF see CD		LM3046	3 60	74C10	65	7453	48
CD4013	90	LH0070	6 20	LM3086	3 75	74C14	2 80	7454	48
CD4014	2 40	LM114H	4 90	LM3900	1 75	74C20	75	7460	48
CD4015	2 40	LM301AN	95	LM3905	3 90	74C85	3 90	7470	85
CD4016	90	LM301CN	95	LM3909	1 50	74C86	2 00	7472	75
CD4017	2 25	LM304H	3 80	MC1035P	2 90	74C90	2 50	7473	80
CD4018	2 25	LM305AH	3 80	MC1312P	4 80	74C154	5 70	7474	95
CD4019	2 25	LM307N	1 60	MC1314P	6 90	74C160	3 60	7475	1 35
CD4020	2 50	LM308V	2 20	MC1315P	10 75	74C162	4 50	7476	90
CD4021	2 25	LM309K	2 60	MC1350P	1 95	74C174	2 50	7480	1 60
CD4022	2 15	LM310N	3 90	MC1351P	3 60	74C192	2 80	7482	2 30
CD4023	55	LM311A	3 60	MC1454G	5 40	74C901	1 95	7483	2 30
CD4024	1 75	LM311H	3 60	MC1458	LM1458	74C925	16 70	7485	2 95
CD4025	55	LM312H	4 90	MC1468L	6 50	80C95	2 20	7486	85
CD4026	3 30	LM317K	6 90	MC1488	LM1488	MISC		7489	4 50
CD4027	1 05	LM318N	5 90	MC1496K	2 75	AL5352	1 50	7490	90
CD4028	1 80	LM319H	7 25	MC1590G	6 75	GL4484	1 80	7491	1 90
CD4029	2 65	LM319N	5 90	MC14553	12 50	GL5253	90	7492	1 20
CD4030	95	LM320K	6 90	MC1648P	4 90	OL31	90	7493	1 20
CD4031	4 70	LM320T	4 50	MC4044P	4 90	RL4484	39	7494	2 20
CD4035	2 35	LM322N	4 50	OM802	3 20	RL5023	35	7495	1 65
CD4040	2 50	LM323K	7 90	SAJ110	2 50	FND357	3 50	7496	2 15
CD4041	2 50	LM324N	4 50	SAK140	2 50	FND500	3 50	74100	3 65
CD4042	1 95	LM325N	4 50	SD305DE	1 30	9001	1 80	74107	95
CD4043	2 25	LM326H	4 50	SD306DE	1 50	9368	3 85	74121	1 20
CD4044	2 25	LM339N	3 70	SL415A	2 70	9601	2 90	74122	1 20
CD4045	3 20	LM340K	4 95	SL425A	1 80	NSN71	2 90	74123	1 40
CD4046	3 20	LM340T	2 70	SL437D	3 60	NSN74	2 90	74132	1 90
CD4047	1 95	LM349N	4 50	SL440		TIL306A	13.80	74141	2 75
CD4049	90	LM358N	3 20	SL442	2 90	11C90	18 50	74145	2 95
CD4050	90	LM370H	4 95	SL447	4 90	95H90	14 50	74150	3 25
CD4051	2 25	LM371N	3 90	SL449	1 60	2102-2	3 75	74151	2 20
CD4052	2 25	LM372H	7 50	SL610C	7 25	2513N	17 50	74153	1 95
CD4053	2 25	LM372N	4 50	SL612C	7 25	S1883		74145	3 20
CD4066	1 45	LM373N	4 70	SL613C	12 50	S50242	15 00	74157	2 20
CD4068	55	LM374N	4 90	SL620C	9 50			74160	2 75
CD4069	60	LM375N	4 90	SL621C	9 50	7805CP	2 90	74164	2 90

SEMICONDS		BC549C	55	In some instances pin for pin substitutes will be supplied					
AC125	1 80	BC559	55	MPF102	65	2N3053	1 20	2N5458	MPF104
AC126	1 80	BC639	1 20	MPF103	85	2N3054	1 70	2N5459	MPF105
AC127	1 80	BC640	1 20	MPF104	1 10	2N3055	1 35	2N5485	MPF106
AC128	1 80	BD131	1 20	MPF105	65	2N3564	65	2N5590	MPF603
AC132	1 50	BD132	1 60	MPF196	1 15	2N3565	55	2N5591	11 30
AC187	1 50	BD139	1 20	MPF121	1 60	2N3566	95	2N6027	1 35
AC188	1 50	BD140	1 20	MRF603	6 90	2N3568	95	2N6084	21 00
AD149	2 60	BD237	1 80	TIP31C	1 20	2N3569	50	BA102	80
AD161/62	4 50	BD238	1 80	TIP32C	1 30	2N3638	55	OA47	60
AS322	18	BD437	2 80	TIP120	3 20	2N3638A	60	OA90	35
AT118	2N301	BD438	2 80	TIP125	3 30	2N3642	55	OA91	35
ASY17	2 65	BF173	1 25	TIP141	4 70	2N3643	55	5082-2800	3 20
BC107	35	BF180	1 20	TIP2955	1 70	2N3694	65	40440	2N3731
BC108	35	BF194	85	TIP3055	1 70	2N3731	5 95	40637A	2 85
BC109	35	BF200	1 30	TT800	2N4037	2N3819	1 35	40673	1 95
BC177	40	BFY50	1 20	TT801	1 20	2N3866	2 75	40822	2 90
BC178	40	BFY51	1 50	2N301	2N2869	2N4037	1 25	40841	1 90
BC179	40	BPX25	4 90	2N706A	1 20	2N4249	65	BZX61	75
BC182	40	BSX19	75	2N918	1 60	2N4250	65	BZX70	1 50
BC212	50	BU126	3 85	2N2222A	1 20	2N4355	65	BZY91	12 50
BC327	55	MFE131	1 95	2N2646	2 50	2N4356	65	PA40	5 85
BC337	55	MJ802	8 90	2N2869	2 70	2N4360	95	PB60	6 50
BC547	55	MJ2955	2 60	2N904A	1 50	2N5245	75	MEL12	1 40
BC548	55	MJ4502	8 90	2N2905	1 20	2N5457	MPF103	FCD820	1 90

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Now you can work into Outer Slobovia on a piece of wet string or load into a rotary hoist for a real clean signal; and if you want to catch and work your CB "good buddy" on 11 metres this 'fine business' machine has 27 MHz built in already.

The 'Charlie Whiskey nut' has it good too, instant break in via inbuilt CW fitter, and if you're worried about losing your ticket for working out of band then forget it 'cos you have upper and lower out of band warning indicator LED's.

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You've got to hear 'em before you can work 'em and so Sensitivity's a must! Like 0.3 microvolt would you believe?

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If you'd like to work some of the guys from NEC on the machine they designed; try

*JH1JEA - Hajime Fukawa
JA2GUW - Osamu Ono
JA1CG - Haruo Takahashi (Special Member)
JA1BCN - Teruo Kawai (Special Member)
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JH1ZQD - NEC Tokyo Club
JR1DGL - Fumio Yamamoto
JE1EVB - Toshio Hirano
JG1SOE - Hiroshi Kamada
JR1INH - Akira Wakana
JF1VSG - (Ex JA7FP) Takaki Kamata
JF1NUM - Saito

NEC

NEC CQ-110E SSB TRANSCEIVER

Oh, we nearly forgot to tell you-the only thing it doesn't have is a JA filter!

RANK AUSTRALIA

CU210/77

Vol.1 No.6 60c

CB AUSTRALIA

How to get into CB Radio

OFFICIAL CB LICENCE FORM (INSIDE)

AVOIDING T.V.I

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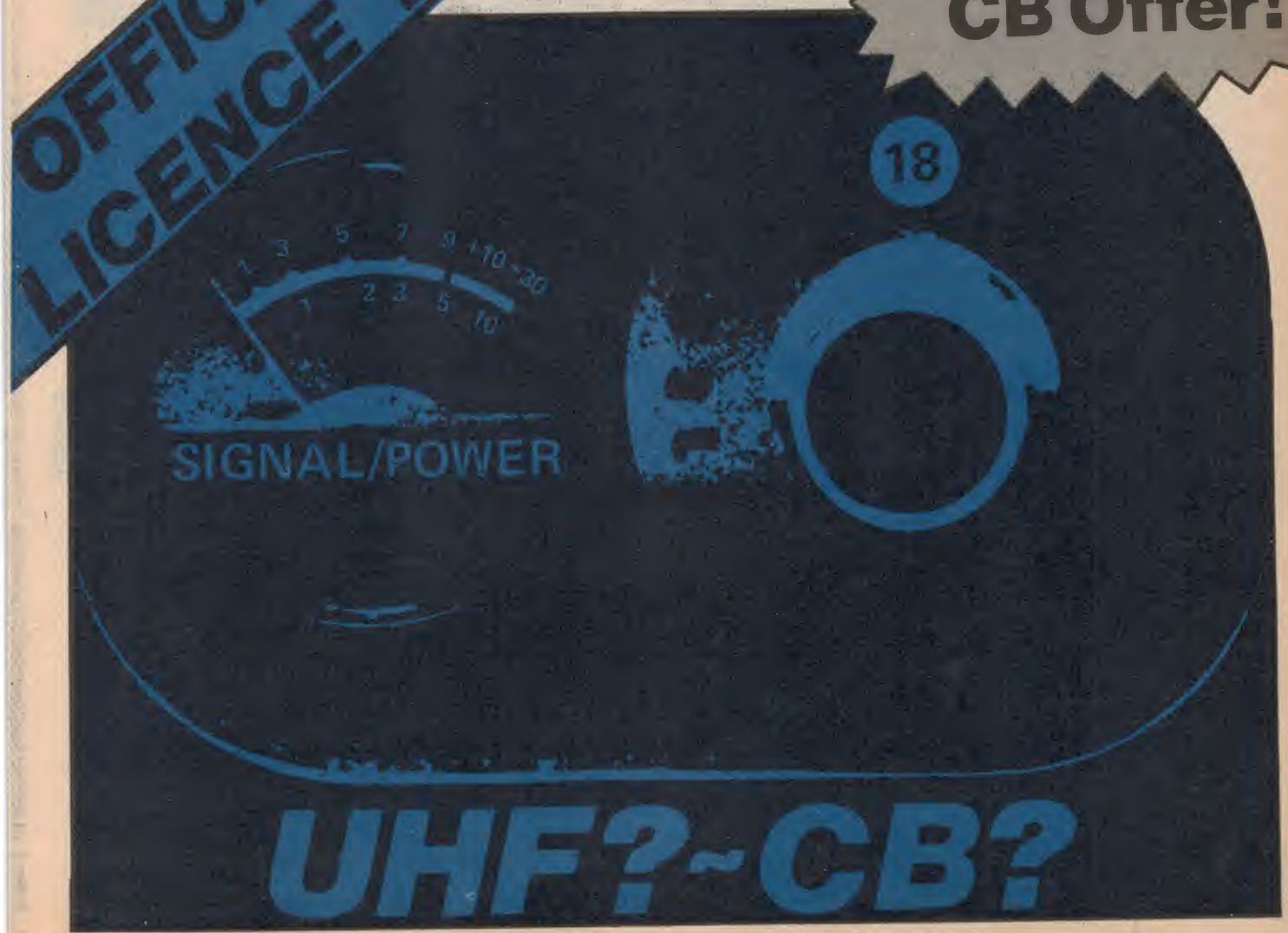

UHF?-CB?

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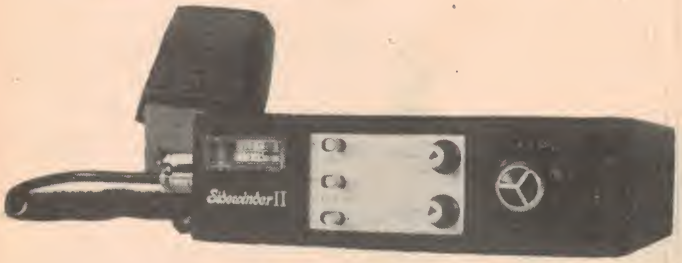


SIDEWINDERII

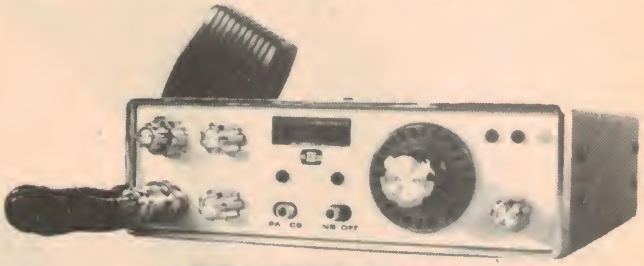
● 23 channel 5 watt crystal controlled ● Synthesized AM CB Transceiver ● Large easy to read illuminated power and "S" meter ● ANL PA/CB Delta tune ● Microphone and mounting brackets supplied ● Receive sensitivity 0.5uV at 6 dB signal/noise.

SIDEWINDER III

● 23 channel 5 watts crystal controlled ● Synthesized AM CB Transceiver ● Large easy to read illuminated power and "S" meter ● ANL, PC/CB, Delta tune — RF gain — Mic gain ● PA output 5 watts ● Microphone and mounting brackets supplied ● Sensitivity 0.3uV at 10 dB signal/noise.

PEARCE-SIMPSON BOBCAT 25D

● 23 channel 5 watt crystal controlled synthesized ● AM/CB transceiver ● ANL PA/CB Delta tune ● Large easy to read illuminated power and "S" meter ● PA audio output 5 watts ● Microphone and mounting brackets supplied ● Receiver sensitivity 0.3uV at 10 dB signal/noise.



EXPO SIDETALK 1000M

● 23 channel AM/USB/LSB crystal controlled phase lock loop CB transceiver ● Large, easy to read illuminated power and "S" meter ● Mode indicator lamps ● RF gain control, clarifier control, PA/CB switch, noise blanker ● Power output 12 watts PEP (SSB) ● Microphone and mounting brackets supplied ● Receiver sensitivity AM 1uV for 10 dB signal/noise ● SSB 0.5uV for 10 dB signal/noise.

AE SPIRIT

● 23 channel 5 watt crystal controlled synthesized ● AM/CB transceiver ● ANL PA/CB Delta tune ● Large easy to read illuminated power and "S" meter ● PA audio output 5 watts ● Microphone and mounting brackets supplied ● Receiver sensitivity 0.3uV at 10 dB signal/noise.

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CB AUSTRALIA

Vol.1 No6.

How to get into CB Radio

CB AUSTRALIA ***How to get into CB Radio***

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Les Bell, ex-GM4CFM
Simon Bracken FX255

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Melbourne	Tom Bray Poppe Davis Tel 51-9836

Publisher:

Collyn Rivers

This, the sixth issue of CB Australia, has been edited and produced by the staff of Electronics Today. It is presented free within the July 1977 issue of Electronics Today, and will also be available at the (recommended) price of 60 cents from all newsagents.

CB Australia is published by Modern Magazines (Holdings) Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011. It is printed by Wilke & Co, Browns Rd, Clayton, Victoria. Issues within Electronics Today are distributed by ACP, other issues by Gordon & Gotch.

A MODERN MAGAZINES PUBLICATION
15 Boundary Street, Rushcutters Bay, NSW 2011

Cover — 18 channels on 27 MHz, with 40 on UHF.

A SPURIOUS EMISSION

AUTHORITATIVE sources in the CB manufacturing industry have suggested that Australia is being used as a 'dumping ground' for CB transceivers that fall short of the FCC's technical requirements.

It seems improbable that this could be so — but since our review of SSB transceivers last month many of our readers are apparently concerned that there could be some basis for these allegations.

It is a fact that of the ten sets reviewed, five would not have had an ice cream in Hell's chance of passing FCC inspection in respect of spurious emissions — one of the most important of the FCC's requirements.

Spurious emissions from a transmitter can (and do!) cause interference to other services, both within and outside the CB band. One transceiver tested last month had a harmonic suppression of −42 dB — the FCC calls for −50dB. This discrepancy of 8dB means that it is *six times worse* than the required specification — *not* repeat *not* a 'mere 25%' as might at first be thought (the dB scale is logarithmic not linear).

This type of result cannot be dismissed as variations in tolerance acceptable within the terms of the FCC's specs. Mass produced items invariably differ one from another but the overall design is such that the performance of the worst (subsequently marketed) device equals or exceeds the standards laid down.

Clearly this was not the case with half the units tested. Of the others, several were more than *ten times better* than the laid down specs for spurious emissions. So it can be done.

Naturally some of the companies handling the sets which we found wanting are less than delighted with our report. Clearly the performance of one sample is not necessarily indicative of the performance of all sets from that manufacturer. But when one has five quite clearly lame sets out of ten one begins to wonder!

We have been told that if we continue to publish such tests we may 'prejudice our advertising support'. But to do otherwise would call into question the reputation for honesty, credibility and integrity that Electronics Today International has acquired since its inception seven years ago.

This is a serious situation that must be resolved. For CB units which emit unacceptably high levels of spurii do harm to the CB cause that will take years to remedy.

CONTENTS

Introducing President CB. The top-of-the-line line.

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We carry all kinds of CB's. But if you won't settle for anything less than the best, President is the line for you.

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CB NEWS

ATDA WELCOMES UHF CB

The Australian Telecommunications Development Association has welcomed the Federal Government's decision to introduce UHF as the approved licensed Citizen Radio service in Australia.

Member firms of the Association who manufacture and distribute Citizen Band radio sets said the decision by the Minister for Post and Telecommunications, Mr. Robinson, would be a boost for the local industry and would help to combat severe competition from overseas manufacturers in low cost labour countries.

The Australian telecommunications manufacturing industry said they were well geared-up to manufacture UHF CB radio equipment — in fact the UHF equipment made in Australia has met the strict specifications laid down by Telecom Australia and has done so for many years.

BASE/MOBILE

Strato have just released a new base/mobile 23 ch. SSB/AM transceiver. The Pearce-Simpson Bengal SSB operates from 240 Vac or 13.8 Vdc.

The receiver is a dual conversion superhet featuring clarifier, squelch, noise blanker and external speaker jack. The transmitter is (of course) fully solid state, and utilises a frequency synthesizer. The circuit employs three crystal-controlled oscillators which are mixed together to produce the desired frequency. Power output is 4 W on AM, and 12 Wp.e.p. on SSB. Although manufactured for the States, where the mains voltage is 117 V, the Bengal is being supplied with a 240 V transformer suitable for use in Australia. The receiver seems pretty hot, with an SSB sensitivity of less than 0.3 microvolts for 10dB S+N/N.

The Bengal is distributed by:*Strato Communications Pty. Ltd., 25 Wentworth Street, Parramatta, NSW 2150.*

CB POWER SUPPLY.

ELECTROPAK is a new 13.8V dc regulated 1 amp power supply specially suited for CB rigs used as base stations

The 1 amp overload protected supply will not 'handle' some high powered SSB rigs which draw more than the specified curren.

Another supply is to be introduced for high power SSB rigs.

Further information:*A&R Electronic Equipment Co, 30-32 Lexon Road, Box Hill, Vic 3128.*

BIG-SCREEN CB

Burt Reynolds demonstrates his normal casual cool; Sally Field her appealing mixture of wide-eyed ingenue and hard-edged girl-of-the-world; Jackie Gleason his ability to overact outrageously and still be funny . . .

"Smokey and the Bandit" is not a CB movie as much as a couple of hours of escapism in which highway mayhem is carried out by CB-equipped vehicles. The plot revolves around an improbable $80,000 wager that The Bandit — a legendary truckie played by Reynolds — can't drive 900 miles from Georgia to Texas, pick up a load of beer, and return within 28 hours. Police involvement is guaranteed: not only must the average speed be 64 mph, but the cargo contravenes several state laws.

The results are predictable, a manic day-and-night chase across the American South-west, punctuated by the usual quota of destroyed vehicles. Gleason plays a Texas Sherriff whose slow-witted son (and deputy) has been stood up at the altar by Sally Field. His desire for vengeance keeps him hard on the Bandit's tail as successive state Highway Patrols drop in and out of the hunt.

The CB angle is predictably spattered with "good buddies" and callsigns such as 'Foxy Lady' and 'The Good Witch of the North', but isn't obtrusive. The cops alternate between driving blunders (which cause crashes), and the skill of a James Hunt in being back with the chase a few minutes later.

The real stars of the show are a magnificent Kenworth semi rig, a mean black Pontiac Firebird Trans-Am and a bassett hound named Fred (what else?). The Bandit drives the car as a blocking vehicle for the Kenworth, handled by his mate 'The Snowman', and Fred takes the whole shebang with an air of gentle sadness.

It's all good clean, fantasy fun. The sex is understated, the language fairly stock by good ol' southern boy standards, and everyone gets on with the business of wrecking as many vehicles as possible.

At the same time, of course, hollering at each other in 23 channels . . . . . .

CB MARKETPLACE

PAIR HAND HELD TRANSCEIVERS 3W. 3ch. Batt. Incl, $120 O.N.O. Ph 08-3373690.

CB Radio Station — Rig, base &mobile antennas, power supply, various accessories, ex. cond. $375 complete. Ph Sydney 449 2631. Ask for Scott.

SANYO- 5 watt, 6 ch. Hand Held, with charger, nicads and case. Paid $160- sell $120. Ph 332 4909.

For sale: 1 CB II Scalar ground-plane, 1 M27 Scalar mobile helical, 1 Sanyo TA-303A 1 watt mobile. Ph 997 2149.

POCKET C.B.

NOW ONLY

$49.95!

PER PAIR.

+ $5.00 P&P PER PAIR.

APPROVED BY P&T DEPT. for licensed service.

THESE two-channel CB transceivers were originally offered by Unitrex at $59.95 each — (ETI, December 1976) and they were really good value at that special price.

Unitrex still have a few left and they are now offering them to our readers at way below even their cost! Would you believe $49.95 *a pair* (plus $5 post and packing per pair)?

These are good light units, so small you really can slip them into your pocket. Their range is about a hundred or so metres in really bad conditions — or up to 5 km across a lake. Their specs are good (see panel) and they're approved by the P&T which is more than you can say for quite a few CBs around at the moment!

We've used these CBs and they're beaut. At Unitrex's latest price they're a steal. If you need a pair — HURRY! Unitrex don't have that many left.

POCKETCOM TRANSCEIVER SPECIFICATIONS

GENERAL		
Nominal operating voltage		3 volts
Low voltage cut-off		2.1 volts
Receiver type		Superheterodyne
Intermediate Frequency		455 khz
RECEIVER		
Sensitivity	10dB S + N/N	$<1.0\ \mu V$
Squelch Sensitivity	–	$<0.4\ \mu V$
AGC Variation	1 μV to 1000 μ V	6 dB
Audio Power Output	60% modulation	20 mW.
Distortion	60% modulation, 100 μ V	<10%
Adjacent Channel Rejection	–	26 dB
TRANSMITTER		
DC Power Input	To final RF stage	100 mW.
Microphone Level	30% modulation	1 mV rms
Modulation Distortion	60% modulation	<10%
Tone Frequency	–	approx 2 kHz
Tone Modulation	–	–90%, +85%
Modulation Capability	–	90%
Power Output	–	30 mW.

To PocketCom Offer, ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2021.

Please send me two transceivers at $49.95 per pair (plus $5.00 post and packing = $54.95). I enclose a cheque payable to ETI PocketCom Offer. *ALLOW 3-4 WEEKS FOR DELIVERY.*

NAME . . . . . .

ADDRESS . . . . . .

. . . . . POSTCODE . . . . . .

CB? — UHF?

THE RECENT ANNOUNCEMENT by Mr Robinson, the Minister for Post and Telecommunication, that CB would be legalised for operation on 27MHz and UHF, changing entirely to UHF after 1982, was hailed far and wide; well, sort of, anyway.

Dick Smith threw a champagne party and put out a call on the band inviting one and all. Even Bill Storer, the RI well known amongst Sydney's pirate CBers, attended! But his attendance didn't dampen the party. As he remarked to reporters, it would hardly be prudent to go busting people now that licensing was so close, would it?

A typical amateur UHF portable, the Trio TR3200 (Photo courtesy Sideband Electronic Sales).

Well, what does the announcement mean for CBers? What does UHF hold in store? Basically, the relatively inexpensive 27MHz equipment now available will be usable for a maximum period of about five years, providing it meets the required specifications to be set down by the P & T Department. At the same time a UHF service will be established, on a frequency band yet to be announced, which, at this stage, will be unique in the world. Although the USA has had a UHF 'CB' allocation in the 470MHz band for about thirty years its purpose and intent is quite different to the service proposed here in Australia. The situation may not last for long though! Reading the technical journals and press from Britain it appears that there is much pressure there for a 'CB' service — and a UHF band seems to be a popular choice, although there are many proponents of, and good reason for, a 27MHz service as well.

UHF — Advantages

UHF operation offers many advantages over 27 MHz. For a start, equipment would use FM which provides clear, noise free signals. Transmitter power outputs of 10 watts or 25 watts are currently available on both commercial and amateur equipment — which would give ranges comparable to or better than current 27 MHz equipment under average to good conditions. Prices of recently available FM equipment for the 430 MHz amateur band are comparable to 23 channel, 27 MHz SSB/AM rigs. UHF CB is not likely to be as expensive as some people predict.

Cost of UHF

Take a look at this. An Australian firm, Willis Communications, had a 50W (!) 430 MHz FM transceiver available last year for $315 with two channels fitted. Size was only 480 mm high, by 196 mm wide, by 202 mm deep! On special they went for $265! An imported unit from Japan, the Standard SR-C430, was selling for $295. This is a 10W, 12 channel (plus memory channel) unit that came with four channels fitted plus mobile accessories and base station stand. Size? — only 84 mm wide by 58 mm high by 235 mm deep. Standard also have a hand-held amateur UHF set, the SR-C432. This is a 6-channel hand-held that puts out 2W and with three channels fitted sold for around $200. The Kenwood TR3200 is another amateur UHF FM transceiver currently being marketed in Australia, imported from Japan, and sells for around $300.

And remember, despite the ravages of inflation, it is likely that UHF transceivers will at least hold to prices around that quoted above — if not actually decrease owing to high volume sales. The technology used in UHF equipment becomes cheaper almost month by month as demand for it increases. A large demand may produce initial shortages but will almost certainly stimulate price decreases. The days of $100 (or less!) 27 MHz CB equipment are definitely limited. Such units are not likely to meet required specifications for long.

Whether or not the P & T will allow powers of 10 W or 25 W on UHF CB is yet to be seen. However, I believe that it is in their interests as well as the interests of local manufacturers to allow powers around this level. For a start, current technology is geared towards this to suit commercial requirements in UHF equipment. Secondly, comparable, if not better ranges may be achieved under most circumstances.

CB?—UHF?

Thirdly, as short range, good quality is a desirable goal, the power levels suggested would seem appropriate to provide this.

Gain Antennas

Another advantage that can be gained from UHF CB is that antennas with quite respectable 'gain' can be used.

A quarter-wave whip on 450 MHz is only 160 mm long! An antenna having four half-waves in phase for mobile operation for example would be only 1.28 metres long and give something like 8 dB gain! That would make a 10 W transmitter sound like a 60 W transmitter! Or a 15 W transmitter sound like a 150 W transmitter! Now you've got to admit that that's something UHF's got over 27 MHz. Sure, you can get gain antennas for 27 MHz. But you're going to have a lot of trouble fitting a comparable 27 MHz antenna to your car. Even 11m base station antennas with respectable gain are getting into the 'unwieldy' category! A gain antenna boosts your signal power in the direction you want it, thus boosting signal strength all round as well as increasing range, especially under difficult circumstances. If they didn't improve matters, nobody would use them.

More Channels

UHF potentially offers considerably more channels than would ever be available around 27 MHz.

How wide would a UHF CB band be? Well, looking at the 11m band as it currently exists in Australia, a band about 1% of the frequency, in width, seems reasonable to assume. The 23 channels on 11m extend over nearly 300 kHz which is a little more than 1% of 27 MHz. Assuming UHF CB were allocated a band near 450 MHz, the band would probably be 3 MHz to 5 MHz wide. If channels were spaced 50 kHz apart, about 80 to 100 channels would be available. If channels were spaced only 25 kHz apart (probably a more reasonable figure) some 160 to 200 channels would be available! Even if a band only 1 MHz wide were allocated, about 40 channels could be accommodated. The American 'Class A' service was allocated 10 MHz from 460 to 470 MHz.

'Skip' propagation is not a problem on UHF. Although certain weather conditions do extend the range of UHF transmissions from time to time the phenomenon is much rarer than skip on 27 MHz. If you want to chase the DX then UHF is not for you! Problems of interference to local, short range communications brought about by skip, that are so prevalent on 27 MHz, disappear on UHF. Skip on 27 MHz will increase over the next few years as we approach the next peak in the sunspot cycle – which greatly affects radio propagation. UHF is unaffected.

Repeaters

One possibility for a UHF CB service that could never be available on 27 MHz would be repeaters. A repeater is a device which receives a transmission on one channel and simultaneously retransmits it on another. Two stations wanting to talk to one another have their transceivers fitted with the repeater receiver channel on their transmitters and the repeater transmitter channel on their receivers. Operation via the repeater would be the same as if they were talking to each other on any other channel. The repeater would be sited at a high location so as to provide coverage over a wide area. Stations unable to communicate directly would be able to use the repeater.

Repeaters are successfully used by many VHF and UHF commercial services, as well as by amateurs, to improve coverage and range. They can provide good quality, noise free communications from many difficult or otherwise 'impossible' locations.

Whether or not UHF CB gets repeaters remains to be seen as many questions would need to be resolved on this score.

Communications Range

I have already said something about range but what sort of ranges would one expect from UHF transceivers? Well, assuming a transmitter of 10 watts power output and a small gain antenna, mobile to mobile ranges would be roughly what you get now from the average 27 MHz AM mobile and whip; that is, a few kilometres in the city and suburbs, 10 to 25 km over water and considerably further when working from a 'good' location. Base station to mobile range depends on the location and antenna height at the base station. UHF offers potentially better ranges in this situation as an antenna with more gain than you could get on 27 MHz could be used to advantage. This would certainly provide better ranges than on 27 MHz. A range of 40 to 60 km from an average location might be obtained. with few 'difficult' areas where communication is bad or impossible.

Base to base communication range may be as much as 150 km but 50 to 80 km in and around suburban areas would be reasonable, although this may be limited by tall buildings, hills etc. in certain directions. In flat or undulating rural areas, distances may be somewhat better.

AVOIDING TVI

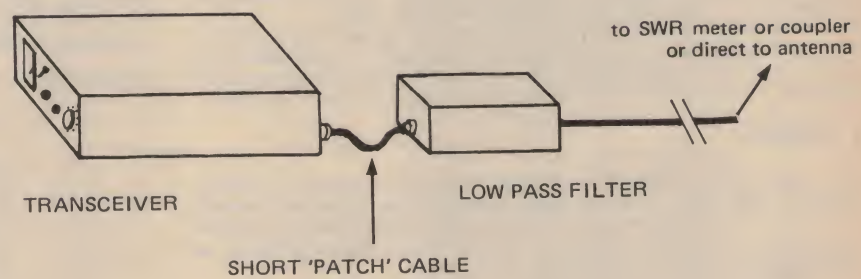

Fig. 1. Connecting a low-pass filter to a CB transceiver

"TENNESSEE VALLEY INDIANS" or television interference – TVI for short – can be a bit of a problem to CB installations. The fault does not lie wholly with the transmitter, nor wholly with the TV receiver.

TV receivers are not really made to cope with strong RF signals close by, even if they may be far removed in frequency. In short, the TV tuner can only take so much, and at some point it will have 'had it up to here' and it overloads and passes the strong signal onto the rest of the TV circuitry. The resultant interference usually manifests itself as black lines or streaks that move about the picture as you talk, or modulate the transmitter. The sound system may even be affected, your transmission 'breaking through' and being heard on the TV set loudspeaker.

This situation usually applies to TV sets located very close to a CB transceiver, such as in the same house as a home or base station.

How do you cure this problem, or avoid it if possible? Well, there are several ways. Firstly, mount the CB antenna as far away as possible from the TV antenna, and higher than it if you can. Don't mount the CB antenna in the 'line of fire' of the TV antenna; ie: in the line between the TV antenna and the TV station. A 'high pass filter' can be obtained from a TV accessories supplier (such as Electrocraft) and fitted to the antenna terminals of the TV set. It is also a good idea to have a coax feedline for the TV as much of the pick-up comes from ribbon feeder widely used on TV antenna installations. Be sure to use 'baluns' at either end. The coax and baluns can be obtained from many electronics parts suppliers or from TV accessories suppliers. Connecting instructions are supplied by the manufacturers.

Ensure that the connections at the TV antenna are properly made and not badly corroded. Clean them up if they are. A properly connected TV antenna and feeder are a must.

Trapping for TVI

These steps usually make a remarkable difference to TVI on a TV set located close to a CB installation. In persistent cases, a 'trap' which prevents 27 MHz transmissions from reaching the TV tuner will have to be obtained and fitted to the antenna terminals of the TV set. Unfortunately, these are not generally available at present and it would be best to call on the assistance of someone you know who is technically competent to fit one for you. Fortunately, these cases are not common.

Well, that largely takes care of the TV set. Now, what about the CB installation?

CB transmitters aren't perfect and they do produce some output that is within the frequency range of TV sets and FM tuners. These 'spurious' outputs may only be very weak, but they are there and neighboring TV and FM receivers may pick them up. Interference is the result. It is a fact that it is impossible to get rid of them altogether – but you can make them so weak that they would be unlikely to cause any trouble!

How do you do that? Well, a device called a 'low pass filter' can be obtained and this allows the 27 MHz signals to pass to and from your transceiver without affecting them, but it reduces any spurious outputs above 27 MHz by a large amount.

Low pass filters range in price from around $10 to $30. Connect one as shown in Figure 1. It should be connected with a short patch cable, the shorter the better. It does not matter which of the filter sockets is connected to the transceiver or the antenna.

A coupler can also assist in reducing spurious outputs from the transmitter. If you use a low pass filter, it should be the closest accessory connected after it.

Ensure that all connectors are properly attached; any loose or corroded joints will certainly aggravate any problems, if not cause TVI.

COMMONWEALTH OF AUSTRALIA
POSTAL & TELECOMMUNICATIONS DEPARTMENT

CONDITIONS GOVERNING THE LICENSING AND OPERATION OF THE CITIZENS RADIO SERVICE
FORM RB14

1. Introduction

1.1 Licences to operate stations within the Citizens Radio Service may be obtained from the Postal and Telecommunications Department. The Citizens Radio Service provides for the operation of a two way radiocommunication system for the passing of messages over short distances.
1.2 Initially, stations may be authorised to operate in either the 27 MHz or UHF band, but transmissions in the 27MHz band will be required to cease on 30 June 1982. Any licence for 27 MHz equipment renewed after 1 July 1981 shall expire on 30 June 1982.
1.3 It should be noted that consideration is being given to a proposal that no new stations will be authorised to operate in the 27 MHz band after 1 July 1979 unless the equipment proposed is a type approved for licensing purposes for single sideband, suppressed carrier operation.

2. Stations

2.1 Land mobile station licences will be issued in respect of Citizens Radio Service stations. These licences will authorise operation primarily in a mobile or portable capacity within the geographic limits of Australia. However, stations which are operated from fixed locations are subject to the following conditions:
(a) stations shall not communicate over distances in excess of 32 kilometres;
(b) all aerials (transmitting and receiving) and structures associated with the station must comply with one of the following requirements:
  (i) the aerial support structure must not exceed 6 metres in height above ground level; or
  (ii) the aerial and its supporting structure must not exceed by more than 6 metres the height of any natural or man-made structure on which it is mounted;
(c) stations shall not cause interference to the reception of sound or vision broadcasting programmes or to the operation of other radiocommunication stations (see Section 4).

3. Licence applications and fees

3.1 The prescribed licence fee, covering operation of a station for any part of a year up to a maximum period of one year shall accompany each application. For operation beyond one year, a licensee must pay renewal fees prior to the expiry date shown in the original licence to ensure continuity of the authority to operate the station.
3.2 An application for licences using form RB13 may be forwarded by mail or personally to the Superintendent, Regulatory and Licensing Section or lodged personally with a District Radio Inspector in the State in which the station is to be operated.
3.3 An application from a person under the age of eighteen (18) years must bear endorsement by the applicant's parent or guardian indicating that the parent or guardian will accept responsibility for the operation of the radio equipment by the person concerned.
3.4 An application seeking licences for a service required by an unincorporated association of persons (enterprises not registered under a Companies Act or not otherwise constituted as a legal entity) must be made by a nominee of such an association who shall state in the application that he is so nominated.
3.5 A licence granted to a person or a nominee of an unincorporated association is subject to a condition that the licence may be revoked in the event of the association withdrawing its authorisation of that person to act as its nominee.

4. Principal operating conditions

4.1 Unless otherwise authorised, stations shall be employed only for the purposes specified in paragraph 1.1 above and apparatus used shall be fitted for operation only on those frequencies indicated in paragraph 5.3 and which are approved for the frequency range of the apparatus.
4.2 Each licence is issued on a non-interference basis only and a station causing interference shall cease operation until effective corrective action has been taken.
4.3 Where the reception of sound or vision broadcasting programmes is being affected by the operation of a Citizens Radio Service station, the licensee shall refrain from further transmissions on each of the frequencies which cause the interference during the operating hours of the broadcasting or television stations affected.
4.4 Stations must accept interference caused by industrial, scientific or medical equipment or by authorised radiocommunication services.

5. Technical requirements

5.1 Equipment to be licensed for operation in the Citizens Radio Service shall comply with one of the specifications shown hereunder:

Frequency Band	Emission	Relevant Specification
27 MHz	6A2, 6A3, 3A2H, 3A3A, 3A3J, 3A3H	RB249
UHF	16F2, 16F3	RB234A, RB234B or RB250, RB234 (provided transmitter output power does not exceed 5 watts)

5.2 A licensee shall cause the approved equipment to be installed and maintained to the satisfaction of the Department and shall not alter the equipment without its prior consent.
5.3 Frequencies available to the Citizens Radio Service, together with operating powers and emissions are shown in the following table:

27 MHz Channels

Channel No.	Frequency	Transmitter Output Power	Remarks
1	27.015 MHz	4 watts (Pm) 12 watts (Pep)	
2	27.025 MHz		
3	27.035 MHz		
4	27.055 MHz		
5	27.065 MHz		*Emergency Calling
6	27.085 MHz		*Calling
7	27.095 MHz		
8	27.105 MHz		
9	27.115 MHz		
10	27.125 MHz		
11	27.135 MHz		
12	27.155 MHz		
13	27.165 MHz		
14	27.175 MHz		
15	27.185 MHz		
16	27.195 MHz		
17	27.205 MHz		
18	27.225 MHz		

*Suggested channel usage

UHF Channels

Channel No.	Frequency		
1	476.425	21	476.925
2	476.450	22	476.950
3	476.475	23	476.975
4	476.500	24	477.000
5	476.525	25	477.025
6	476.550	26	477.050
7	476.575	27	477.075
8	476.600	28	477.100
9	476.625	29	477.125
10	476.650	30	477.150
11	476.675	31	477.175
12	476.700	32	477.200
13	476.725	33	477.225
14	476.750	34	477.250
15	476.775	35	477.275
16	476.800	36	477.300
17	476.825	37	477.325
18	476.850	38	477.350
19	476.875	39	477.375
20	476.900	40	477.400

Transmitter Output Power: 5 watts Pm.
Remarks: Channels 1 to 10 and 36 to 40 may be used without restriction. Channels 11 to 35 will be available to the Citizens Radio Service at a date to be announced.

5.4 No allowance will be made for power losses in aerial feeder cables and coupling devices.
5.5 Except in special circumstances approved by the Department, the use of parasitic or driven elements to provide aerial gain is not permitted. However, reactive loading of aerials may be employed.
5.6 No external radio frequency power amplifier shall be used or attached, by connection, coupling attachment or in any other way at a Citizens Radio Service Station.

6. General Provisions

6.1 The licensed installation and the licence document must be available for inspection on demand by an authorised officer.
6.2 The official callsign shall be prominently displayed on the equipment.
6.3 The official callsign shall be announced by each station at the commencement and conclusion of each series of transmissions:

e.g. Initiating call — "Hullo VAA 123 this is VBB 456 . . . message . . . over"

Reply — "This is VAA 123 romeo out".

6.4 Adequate precautions must be taken to safeguard the radio equipment against unauthorised use.
6.5 A station must be constructed in such a manner as not to constitute a danger to the operator or other persons. Electrical wiring associated with the station must comply with the safety standards required by the relevent Electrical Supply Authority.
6.6 In cases of emergency, the licensee of an authorised station and persons employed by him shall, so far as possible, receive from other stations all requests for assistance and all signals of distress and shall answer those requests and signals and transmit them with the least possible delay to the proper authorities by means of the authorised station or by any other means in the power of the licensee.
6.7 The Department may, during the currency of the licence, vary all, or any of the conditions upon which the licence was granted. The licensee shall, at his own expense, give effect to such variations.
6.8 A person shall not transmit or make a signal containing profane or obscene words or language, or transmit improperly the callsign of another station or any signals not necessary for the conduct of tests or traffic.
6.9 Aerial structures must comply with town-planning legislation, local building regulations and the requirements of the Department of Transport. The licensee is responsible for ensuring that all relevant statutory rules relating to aerial structures are strictly observed. Failure to comply with these requirements may invite prosecution as well as demands for immediate removal of the offending structure.
6.10 A prospective licensee should also ascertain from the local Municipal or Shire Council whether establishment or operation of the station would violate town-planning regulations.
6.11 The grant of a licence shall not relieve the licensee of responsibility for any infringement by the licensee of any patent for an invention, any breach of copyright, or any breach of any law, arising out of the exercise of the licence.
6.12 Neither the Australian Government nor the Minister shall be liable or responsible for any such infringement or breach committed by a licensee or his agent.
6.13 Licences may be revoked or suspended by notice in writing for a period as is specified in the notice on the ground that:
(a) the licensee has failed to comply with any provision of the Wireless Telegraphy Act or of the Regulations made under that Act or with any condition of the licence; or
(b) the revocation or suspension is considered to be advisable in the public interest.
6.14 The licensee shall not be eligible for any compensation or consideration in the event that a licence is revoked or suspended for any reason.
6.15 A holder of a licence shall, within two weeks after a change in his address, notify in writing the Superintendent, Regulatory and Licensing, Postal and Telecommunications Department, in the State in which he resided before the change, of his new address, and the address so notified shall then be deemed to be the address specified in the licence.
6.16 A licensee who disposes of his station to another person must notify in writing the Superintendent, Regulatory and Licensing or a District Radio Inspector of the name and address of such person.
6.17 Every licence shall be subject to the provisions of any regulations made from time to time under the Wireless Telegraphy Act so far as they are applicable to the licence, and those provisions shall be deemed to be incorporated in the licence.

7. Transitional technical requirements

7.1 As from 1 July 1977 the Department will license typical US Citizen Band type equipment for operation only on the frequencies listed in the Section 5.3 provided:
(i) the channel capacity does not exceed 23 channels; and
(ii) transmitter output power does not exceed 4 watts (Pm) or 12 watts (Pp).
7.2 As from 1 September 1977 no equipment shall be licensed unless it meets the technical standards applying to Class D equipment set out in paragraph 95 of the Rules and Regulations published by the US Federal Communications Commission in April 1976. Operation of this equipment shall be restricted to the frequencies listed in Section 5.3.
7.3 As from 1 January 1978 all new or replacement 27 MHz equipment must comply with technical performance specification RB249.
7.4 All UHF equipment must comply with specification RB234 (provided output power does not exceed 5 watts), RB234A, RB234B or RB250.

ADDRESSES AND TELEPHONE NUMBERS
Postal and Telecommunications Department
Radio Frequency Management Division

Assistant Secretary, 562 Bourke Street, Melbourne, 3000. (Postal: G.P.O. Box 5412cc, Melbourne, 3000)
Telephone: 03 602 0151)

REGULATORY AND LICENSING SECTION

NEW SOUTH WALES

Superintendent, 23 Berry Street, North Sydney, 2060. (Postal: P.O. Box 970, North Sydney 2060) (Telephone: 02 929 8588).

District Radio Inspector, 741 Hunter Street, Newcastle West 2302. (Postal: P.O. Box 2189, Dangar, 2309) (Telephone: 049 69 1400)

District Radio Inspector, 28 Bridge Street, Tamworth, 2340. (Postal: P.O. Box W75, West Tamworth, 2340) (Telephone: 067 65 7969)

District Radio Inspector, 8 Station Place, Wagga Wagga, 2850. (Postal: P.O. Box 266, South Wagga Wagga, 2650) (Telephone: 069 21 1855)

District Radio Inspector, Australian Government Offices, Molesworth Street, Lismore, 2480 (Telephone: 066 21 1233)

District Radio Inspector, Australian Government Offices, 86-88 Market Street, Wollongong, 2500 (Postal: P.O. Box 1766, Wollongong) (Telephone: 042 28 9611)

VICTORIA

Superintendent, 337A Lennox Street, Richmond, 3121 (Postal: P.O. Box 2208, Richmond South, 3121) (Telephone: 03 42 3721)

District Radio Inspector, 118 Armstrong Street, South Ballarat, 3350 (Telephone: 053 31 4045)

District Radio Inspector, 78 Arundel Street, Benalla, 3672 (Telephone: 057 62 3031)

District Radio Inspector, Cnr. Forest & McKenzie Streets, Bendigo, 3550 (Postal: P.O. Box 458, Bendigo, 3550) (Telephone: 054 43 1110)

District Radio Inspector, Australian Government Centre, 79-81 Raymond Street, Sale, 3850 (Telephone: 051 44 3511).

QUEENSLAND

Superintendent, Cnr. Brunswick & Amelia Streets, Fortitude Valley, 4006 (Postal: P.O. Box 555, Broadway, 4000) (Telephone: 07 52 8822).

District Radio Inspector, Post Office, Bourbong Street, Bundaberg, 4670 (Postal: P.O. Box 862, Bundaberg, 4670) (Telephone: 071 72 2135)

District Radio Inspector, State Government Insurance Office, Cnr. Shields Street & The Esplanade, Cairns, 4870. (Postal: P.O. Box 1225, Cairns, 4870)

District Radio Inspector, Airport, Mackay, 4740 (Postal: P.O. Box 337, Mackay, 4740) (Telephone: 079 51 1828)

District Radio Inspector, Room 1, 38 Marion Street, Mt. Isa, 4825 (Postal: P.O. Box 2329, Mt. Isa, 4825) (Telephone: 077 43 6672)

District Radio Inspector, 6 East Street, Rockhampton, 4700 (Postal: P.O. Box 1401, Rockhampton, 4700) (Telephone: 079 27 6922)

District Radio Inspector, 42-50 Sturt Street, Townsville, 4810. (Postal: P.O. Box 522, Townsville, 4810) (Telephone: 077 71 5685)

SOUTH AUSTRALIA

Superintendent, QBE Building, 108-116 King William Street, Adelaide, 5000 (Postal: G.P.O. Box 2248, Adelaide, 5001) (Telephone: 08 212 2153)

District Radio Inspector, 40 James Street, Mount Gambier, 5290 (Postal: P.O. Box 1545, Mount Gambier, 5290) (Telephone: 087 25 6170)

District Radio Inspector, Custom's House, Horwood Street, 5600 (Postal: P.O. Box 575, Whyalla, 5600) (Telephone: 086 45 5999)

WESTERN AUSTRALIA

Superintendent, Cable House, 1st Floor, CAGA Centre, 256 Adelaide Terrace, Perth, 6000 (Postal: P.O. Box 6189, Perth, Hay Street East, 6000) (Telephone: 092 25 5877)

TASMANIA

Superintendent, Knopwood House, 38 Montpelier Retreat, Battery Point, 7000 (Postal: P.O. Box 63, Sandy Bay, 7005) (Telephone: 002 20 4777)

AUSTRALIAN CAPITAL TERRITORY

District Radio Inspector, 7 Sargood Street,,O'Connor, 2601 (Postal: P.O. Box 40, O'Connor, 2601) (Telephone: 062 47 0677)

NORTHERN TERRITORY

District Radio Inspector, CML Building, 61 Smith Street, Darwin, 5790 (Postal: P.O. Box 2540, Darwin, 5794) (Telephone: 089 81 5566)

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STRONG HEAVY DUTY UNIT WEIGHS OVER 3LB

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See P&T for license requirements

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Specially made to charge the nicad batteries in the Sanyo unit at left.
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EXTRA CRYSTALS **$7.50**

We have an excellent range of 27MHz crystals.

27.240 Cat.D-6024	Ch 5 Cat.D-6001	Ch 12 Cat.D-6010
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DSE3ET77

COME-ON

We Hand The Mic To Our Readers...

WHAT WILL HAPPEN TO 27MHZ ?

THE EXISTING 27MHz band is to be used for the licensed CB service until 1982 only, when CB will all be moved to UHF. The Government has not said, to date, whether amateurs will retain use of their 11m allocation and share it with the CB service for the next five years or whether they will lose the use of it until 1982 and be able to return to it after that (subject to what happens in WARC at Geneva in 1979), or whether they will lose it altogether. We might know on July 1st, or it may remain somewhat of a quandary.

Not one to leave things to chance, or the machinations of the bureaucrats, Sam Voron of the Citizens Amateur Radio Movement, has rustled up a submission on the subject of what happens to 27MHz over the next five years and thereafter.

Taking precedent from what has happened over the last six months or so since CB really hit the headlines, Sam suggests that both amateurs and CBers could benefit from sharing 27MHz until 1982. It appears that a number of CBers realise that their interests actually lie more in the direction of amateur radio, still others see advantages available to them in amateur radio that CB does not offer while some amateurs see CB as a potential recruiting ground for 'fresh blood'. Sam also points out that amateurs could offer practical, technical assistance to CBers in many areas. These sort of interactions between CBers and amateurs already exist and have been going on for some time as many amateurs realised the legitimacy (or perhaps the inevitability ?) of the CBers claims to spectrum space.

Now read the submission reproduced here and see what you think, even if you can't stand ham radio. This is a copy of a letter sent to the Minister for Post and Telecommunications, Mr. Robinson, by Sam Voron on behalf of the Citizens Amateur Radio Movement:

Sir,

Together with several active amateurs who operate daily on the 11 metre band, I have been providing an 11 metre novice course on the air to assist CB operators in preparing for the May novice examinations. For 2 months prior to the novice exam a 2 hour session was conducted each Saturday from 8 to 10 p.m. on 27.135MHz (Channel 15) using AM. The session was entitled "The 11 metre novice course on the air" – "for participating network stations" (the latter announcement overcame the restriction on general broadcasting). During these sessions alternating 10 minute segments covered novice theory questions, answers and discussions, morse code practice at 5 words per minute and regulations questions, answers and discussions with regular announcements that "the handbook for operators of radio stations in the amateur service was available from the radio branch for 30 cents". In addition, a daily half hour morse code practice session was conducted on 27.135MHz from 8 to 8.30 p.m. with regular AM announcements directed to a specific station again to overcome the general broadcast restriction. This, together with the two Sunday W.I.A. Broadcasts at 11 a.m. and 7.30 p.m. and the daily operation by amateurs using AM on 27.125MHz (channel 14), has resulted in a special relationship and understanding which has evolved on the 27MHz band where once conflict between legal and illegal operators had existed.

This involvement by amateurs on the 27MHz band has been carried out in the framework of "We can't legally talk to all those people on 27MHz although we recognise our interest and enthusiasm in the same hobby so let's provide information about amateur radio together with a complete on-air course for the novice licence all within the legal framework."

The effect of this direct involvement between amateur and CB radio operators in Sydney both on air and at the club level has been that Sydney has had the biggest number of applications for the novice examination compared to any other part of Australia where little such direct activities have been occurring. Amateur radio regulations booklets have been sold out for some time. Talking with CBers off the air as well as listening on the air, it was clear that even though legalization was the excitement of the day, it had not displaced the interest among CBers in obtaining their novice licences. For others, CB is virtually seen as a 4th class of amateur licence, and with amateur encouragement and assistance, it will be these CBers from which the bulk of most of our future amateurs will be found in Australia just as is the case at present in the United States.

I believe that amateur radio operators can help solve some of the major problems CB faces:–

(1) CROWDING

The large numbers of new operators who will shortly come on to the 27MHz band, will mean that the method of handling on-air difficulties caused by crowding will become

the norm which the new-comer will adopt. Operating procedures used to handle the crowding effect can either contribute to an atmosphere of tolerance, adequate coping strategies and understanding of the various interfering situations that crowding gives rise to or to attitudes of intolerance, abuse, lack of consideration and lack of understanding of the situational factors and the effect of one's actions on others. Newcomers will be no better than those already on the air from whom they will learn the standards of on-air operation which will need to be modified for a whole range of different on-air situations apart from just crowding. For example, when someone transmits on top of another station unintentionally, one can either say "Sorry this frequency is in use" or a less friendly atmosphere can be created by "Get off this frequency". The creation of this type of friendly or unfriendly atmosphere will have a big effect on the newcomer in particular, as well as on the manner in which on-air activities are conducted generally. These examples have already been developed by amateurs who by experiencing the changing conditions on 27MHz have modified their operating practices to cope with the situation by making for a more pleasant atmosphere on a crowded band.

Amateur radio operators whose hobby is communications in a diverse range of communications conditions can make an important contribution in helping to make the UHF CB allocation and the 27MHz transitional CB allocation a success by assisting both present day CBers and the future Australian community, who will be looking for guidance on the air in large numbers once legalization is introduced.

(2) THE 27MHz TRANSITION TO UHF BY 1982

Amateur participation can assist in a successful transition by 1982 by assisting those who have developed an interest in the hobby of radio communications to obtain their novice amateur radio licence and so continue to operate on 27MHz after 1982 as novice amateurs, or it may become possible to introduce a new class of amateur licence before this date, which could reflect changes to the international amateur service regulations at the I.T.U. World Conference in 1979 as well as the feelings of the W.I.A., CB hobbyist and the aims of the transitional requirements for orderly use of the 27MHz band.

(3) CB ON UHF

Before and after the transitional period, CB on UHF will face developing challenges and increasing numbers. Once again amateur involvement can play an important on-air role in helping to make CB radio in Australia a success by offering the citizen technical and practical assistance on the air as well as setting an example of good operating practices. Amateurs can additionally assist those CBers who develop an interest and enthusiasm in the hobby to gain the knowledge needed to obtain an amateur licence which permits hobby radio communications with people all over the world with the use of linear amplifiers, beam antennas and so on.

(4) CB AS DEFINED BY

"A short range personal two-way communications system"—its effect on the amateur radio service as a hobby recreational activity.

CB on UHF or on 27MHz will, just as it has in the United States, develop within the citizen an interest and enthusiasm in the hobby of radio communications which can become the motivation to obtain the present novice or future communicator amateur licence. Both amateur and CB hobbyists can organise on-air activities to assist CBers to gain the knowledge needed to obtain the novice amateur radio hobby licence which will assist the operating his or her equipment both as a CBer and future novice amateur.

CONCLUSION AND RECOMMENDATION

Considering the transitional nature of the 27MHz allocation to the CB Service, and that amateurs have been sharing the 27MHz band with large numbers of CB operators up to date, and also the need to maximize a successful transition by 1982 and at the same time cater for those who wish to remain on 27MHz because of a hobby communications interest, and that for many amateurs, especially novice licencees the only equipment they possess only covers the 27MHz band, and that any additional 10 metre allocation would only be of value to those who could purchase the expensive multiband transceivers which are the only items currently covering the 10 metre allocation, and that many novices do not have the knowledge to modify existing 11 metre transceivers using sophisticated frequency generating techniques, I feel that it is important that **Amateurs be allowed continued use of the 27MHz band and that recognising all these considerations, intercommunications between amateur and citizen stations be permitted and encouraged to the benefit of both services and towards promoting a successful transition.**

HISTORICAL SUMMARY

If the amateur movement is not encouraged to participate in the developing situation, as was the case in the United States, then I feel that like the United States, it will be many years before the amateur radio movement recognises its self-imposed isolation and undertakes active involvement and co-operation with the CB Service. It has taken the amateur service in the United States some 15 years to come to terms with CB radio. Little amateur contact with the CB movement in America meant CBers knew little about amateur radio and thus had little chance of developing an interest in something they knew little about. It is only recently that the A.R.R.L. as the representative of amateurs in the United States has recognised that present and future amateurs will come and are coming from the CB ranks. A situation of cooperation and active interaction between CBers and amateurs is under way in the United States with 68,000 people (mainly CBers) involved in A.R.R.L. organised novice training courses being conducted this year across the United States.

In Australia, we have the benefit of past experience and we have the opportunity to by-pass 15 years of fear and isolation which the American amateur service had to pass through under similar conditions which we face here today.

I feel confident that amateur, citizen and government consideration of this issue can be of benefit to both the amateur and citizen radio services.

In this same spirit of confidence, I am forwarding copies of this letter to both amateur and citizen groups.

Yours Sincerely,

Sam Voron, VK2BVS,
for the Citizens Amateur Radio Movement.

CITIZEN BAND APPLICATION FORM

OFFICE USE ONLY

CALL SIGN

1. NAME OF APPLICANT

2. ADDRESS

Street and number

Suburb or town

Postcode:

3. TELEPHONE

Business:

Private:

4. RADIO EQUIPMENT TO BE EMPLOYED

(a) Name of manufacturer

(b) Type and serial No(s)

5. NUMBER OF STATIONS FOR WHICH LICENCES ARE REQUESTED

I certify that I have read the licensing brochure RB14 and that any station(s) licensed in my name will be operated in accordance with the conditions outlined and in conformity with any subsequent additional conditions or amendments as may be introduced from time to time.

Signature of Applicant/Nominee

Enclosed please find (✓ as appropriate)

Cash

Cheque

Money Order

for $

/ /
Date

POSTAL AND TELECOMMUNICATION DEPARTMENT

CITIZEN RADIO SERVICE LICENCE APPLICATION RB13
(June 1977)

DECLARATION BY PARENT OR GUARDIAN
(If applicant is under 18 years of age.)

I _____ accept responsibility for the operation

by _____ of the radio equipment referred to in this

application in accordance with the conditions of the licence.

RELATIONSHIP TO APPLICANT

SIGNED

/ /
Date

Declaration when Licenses are required by an Unincorporated Association of Persons:

I hereby declare that I have been nominated by _____

to obtain the licence(s) herein applied for on behalf of that association.

SIGNATURE OF NOMINEE

/ /
Date

NOTE- This application is to be completed clearly and forwarded to the Superintendent, Regulatory and Licensing, in the State or Territory in which the station will be operated.

FCC TYPE ACCEPTED. FCC DATA 242--0352D

23 AM CHANNELS PLUS 46 SINGLE SIDEBAND CHANNELS

JOHNSON CB

Viking 352D Digitally synthesized

Highly functional professional design, improved SSB performance

The Viking 352D is a 23-channel AM/SSB mobile 2-way CB radio with automatic circuitry and individual professional controls to give the user a straight-forward approach to high level sideband performance. For ease of operation, Johnson provides precise individual controls for RF gain, fine tuning, volume and squelch. Channel selector is fully rotatable and has an illuminated indicator. A separate control with colour-keyed lights indicates AM, USB or LSB operating mode at all times. A noise blanker to slice out ignition noise is activated by a simple two-position switch. Another switch is provided for the built-in public address function. Inside the Viking 352D crystal lattice filtering rejects adjacent channel signals and a fully automatic noise limiter assures clean, clear reception. The voice-tailored audio system drops off signals above and below voice frequencies for additional clarity. Viking 352D also features Johnson's electronic speech compression and full allowable power for strong, crisp transmissions. The unit is assembled in Japan according to Johnson's exacting engineering and quality control standards. Viking 352D can be installed in positive or negative ground vehicles or with an AC power supply it becomes an attractive SSB base station.

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MS118

CB NEWS

The Minister for Post and Telecommunications, the Hon. Eric Robinson has announced the arrangements for the introduction of the Australian Citizen Band Radio Service.

Licensing

Licensing of CB Radio transceivers commenced on 1 July 1977. The **licence fee** is $20 per annum for each unit. Applications for licences should be lodged at any of the Postal and Telecommunciation Deprtment's State and District Offices.

It will be necessary to advise the name and address of the licencee, make, model and serial number of the equipment and pay the fee in order to obtain a licence.

The Minister said that the Government wished to see an early start to the service and to achieve this it would be necessary to commence licencing under existing legislation. It is recognised that **the form of licensing proposed is not entirely suitable** for this type of radio service and consideration is being given to a simpler licensing system. Before this could be introduced it would be necessary to amend the Wireless Telegraphy Act.

Technical Standards and Operating Requirements

Details of the technical standards, specifications and operational requirements may be obtained from the Department's State and District Offices. In brief, **the UHF CB equipment will provide for 40 channels at 25 kHz spacing within a 1MHz section of the UHF band near 470 MHz.**

The interim 27 MHz HF CB service will provide 18 channels of which 16 are the same as channels incorporated within the old USA 23 channel equipment with two additional channels falling between USA channels 11/12 and 19/20.

Exemptions

From 1 July to 31 August 1977 people in possession of HF CB equipment fitted with up to 23 channels may have their equipment licensed provided it meets power limits (4 W DSB or 12 W SSB). From 1 September to 31 December 1977 only equipment providing no more than 23 channels and which meets the USA 1976 technical standards (or better) will be licensed. Licenses may be renewed by the original licencee for the term of the service.

It should be noted that as a licence condition **people licensing 23 channel transceivers will be restricted to operate on only the specified 16 channels.**

From 1 January 1978 only equpment which meets the new Australian HF standard may be licensed. Initially, both double sideband (AM) and single sideband equipment may be licensed. However, it is proposed that the **provision of the SSB facility become mandatory** for equpment licensed after June 1979.

Interference

Continuous warnings have been expressed about the actual and possible interference which can be caused to other authorised users of the radio spectrum by the operators of HF CB equipment. It is largely for this reason that it has been considered necessary to restrict the HF CB service to 18 channels and to introduce more demanding technical specifications. To further assist in minimising interference **the CB service is to be regarded as a mobile communication service from motor vehciles.** Applicants for licences to operate fixed CB stations will need to satisfy strict requirements regarding interference to electronic equipment operated by their neighbours.

The Minister issued a warning that the use of linear amplifiers and high gain aerials with CB stations would be prohibited. Anyone detected using this type of equpment would have their licence cancelled. In addition a special warning was given that **the use of 40 channel USA type CB equipment was banned.**

Call signs

The license number will also be the call sign. In the case of recognised CB clubs **consideration is being given to the use of a club call sign** provided that the club provides the Department with a list identifying the licence number against the club call sign and the list is kept up to date.

PHILIPS UHF-CB IN JAN 78

Mr Huyer, chairman of Philips Industries Holdings Ltd, said Philips laboratories in Melbourne have been working on an Australian prototype UHF-CB radio.

The sale date is set for January and Philips is preparing for production. With long production runs Philips believes it can compete with overseas markets. The sets are expected to sell for $300 with an antenna.

Philips has been producing UHF two-way mobile radios for taxis, police, and emergency services for many years.

OOPS!

Last month we gave the wrong phone number for the Ministry of Post & Telecommunications. The correct number (for Sydney), is 929 8588. For other areas see the list on page 11.

...tops for amateur radio

VICOM didn't reach the top without providing Amateurs in Australia with the technical back-up and support demanded in marketing specialised sophisticated commercial equipment. Come and see our wide range of transceivers and accessories and receive some of that friendly personalised service for which VICOM has become famous!

ANTENNAS & ACCESSORIES

MOBILE ANTENNAS

MARK HELICAL WHIPS (6 ft.)

HW40	40 metres	$31	HW20	20 metres	$31
HW80	80 metres	$31	LDS spring		$13
HWM–1 base assembly		$18			

HUSTLER RESONATORS

RM80	80 metres	$26	RM20	20 metres	$22
RM40	40 metres	$25	RM15	15 metres	$22
RM10	10 metres	$22	RM11	11 metres	$19
RSS–2 spring base		$11.50			
BM–1 bumper mount kit		$19			

VHF/UHF BEAM ANTENNAS

JAYBEAM

5Y/2m 5el 2m 7.8dBd gain	$26
8Y/2m 8el 2m 9.5dBd gain	$30
10Y/2m 10el 2m 11.4dBd gain	$57
10XY/2m crossed yagi 11.3dBd	$66
D8/70 twin 8el 12.3dBd gain	$46
PBM18/70 18el 70cm 14.9dBd	$57
MBM8870 88el 70cm 18.5dBd	$66
MBM4870 48el 70cm 15.7dBd	$55

ASAHI

AS210AN 10el 2m 14.5dB	$49
AS210BN twin 10el 18dB	$119

BASE & MOBILE

ARX–2 Ringo Ranger for 2m	$45
Lindenow 5/8 mobile whip	$26

PARABOLIC DISH ANTENNA

For 430 and 1296MHz	$349

NOISE BRIDGES

TE7–01 up to 100MHz	$38
TE7–02 up to 300MHz	$48

ANTENNA COUPLERS

CL66 HF incl coax switch	$139
CL65 HF	$128
CL99 for 2 metres	$59
CSW216 incl swr/pwr meter	$210

SWR/PWR METERS

VC2 3–150MHz twin meters	$36
SWR200 professional Oskerblock	$59
SW410 VHF/UHF 140–500MHz	$99

ROTATORS

Heavy Duty ART3000C with control box	$189
Medium Duty CD44 with control box	$192
Light Duty AR22XL with control box	$99

MORSE KEYS

Economy model, HK708	$17
Operator model, HK706	$19
Deluxe Model, HK702	$32
Electronic keyer with memory	$149

QM70 PRODUCTS

2 metre linear amplifier, 70w pep	$119
28/144 SCORPION transverter	$225
432/28 Converter	$50
144/28 Converter	$45
1296/28 Converter	$60

SPEECH COMPRESSORS

MC33A with compression level meter	$65
MC22 as above without meter	$54

VHF HANDBOOK FOR RADIO AMATEURS: Includes information on FM theory, design, equipment, moon reflection and how to build converters and transceivers for VHF $9 + P & P

EA LOG BOOK: Packed with information, codes, frequencies for radio & T.V., FM standards, call areas etc. $2.95 + P & P

ICOM

ICOM Transceiver 2M FM IC 22S

$269

IT'S CRYSTAL CLEAR!
The **IC22S** from **VICOM** is a p11 synthesised rig with programmable ROM for any frequency multiple of 25KHz from 146 thru 148MHz. Simplex, duplex or duplex reverse is achieved by a flick of a switch on the front panel. This fabulous new rig features ceramic discriminator, IDC, electronic tx/rx relay, full swr protection and VICOM 90 day warranty. Circuitry includes 34 transistors, 7 FET, 13 ICs, and up to 128 diodes. Receiver sensitivity better than 0.4uV for 20dB quieting. Your new IC22S comes complete with mic, mobile mounting bracket, plugs, cables, spare diodes and English instruction manual. Programmable matrix is pre-wired for R1–8, 40, 50, 51. A real bargain at **$269** plus freight and insurance.

ICOM IC-245

VICOM brings the VFO revolution to you with the IC245 mobile 144 thru 148MHz transceiver. The IC245 features accurate tuning over 50 detent steps, digital display in 5KHz steps, modes: fm, ssb (with optional adapter only) and cw. Carrier suppression better than 40dB. TX output 10w fm. Comes complete with mic, bracket, manual and VICOM 90 day warranty. List price **$479.**

IC215 HANDY FM PORTABLE

This is ICOM's first FM portable, and it puts good times on the go. Change vehicles, walk through the park, climb a hill, the ICOM quality FM communications go right along with you. Long lasting internal batteries make portable FM really protable, while accessible features make conversion to external power fast and easy!

- Fully collapsible antenna
- 15 channels (12 on dial + 3 priority)
- Dual power 3 watts/40 mW
- Lighted dial and meter
- Crystals same as IC22 series

$199

Your new IC215 comes complete with 3 popular channels, mic, shoulder strap, connectors, batteries, English Manual and VICOM 90 day warranty.

UNIDEN .... the best value

The fabulous **UNIDEN 2020** p11 transceiver offers separate usb, lsb and cw 8-pole filters as **STANDARD** and 6146Bs in the final with screen grid voltage stabilisation for minimum distortion products. Features pcbs and even the front panel can be swung out for easy servicing! A comprehensive range of spare parts is available together with back-up service support. Overseas this rig sells for at least $65 more than the FT101E! Compare the features of the UNIDEN 2020 with other HF transceivers and you'll quickly be convinced that it offers the best value! Price **$772**, external VFO $145, speaker, $46.

ICOM IC211 2m fm transceiver
The new IC211 from **VICOM** is the last word in digital 2m, all-mode transceivers. Fully synthesised in 100Hz or 5KHz steps, has dual tracking, optically coupled VFOs with 7 digit LED readout. One knob controls all frequencies. Modes fm, usb, lsb, cw. Internal 240vac and 13.8vdc power supply. Comes complete with VICOM 90 day warranty. List price **$785** plus freight and insurance.

TRIO-KENWOOD DISCOUNTED! ✱ ✱

TR7400A 2m mobile
This brand new mobile transceiver with the astonishing price tag is causing quite a commotion. Two metres with 25w or 10w output (selectable), digital readout, 144 thru 148MHz and 800 channels are some of the features that make this such a great buy at **$379.**

TS-520
80-10M TRANSCEIVER

The transceiver that has made the Kenwood name near and dear to amateur operators around the World. Reliability is the name of this rig in capital letters! 80 thru 10 metres with many built-in features for only **$630!** Special price to 31st July only.

KENWOOD
Transceiver
TS-820
160 thru 10M

$960

The TS820S from **VICOM** is the rig that is the talk of the Ham Bands. Too many built-in features to list here! What a rig and only **$960** complete with digital display! Many accessories available to increase your operating pleasure and station versatility.

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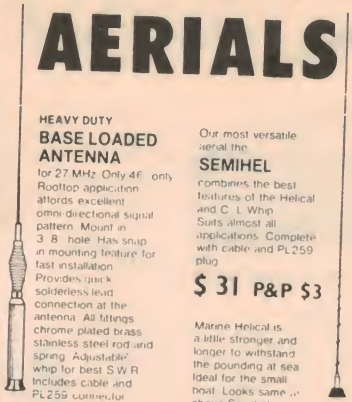

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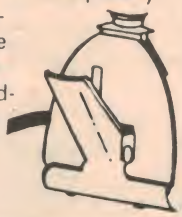

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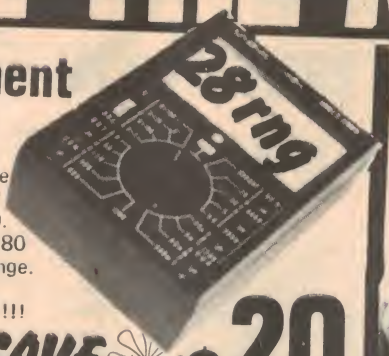

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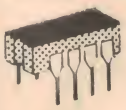

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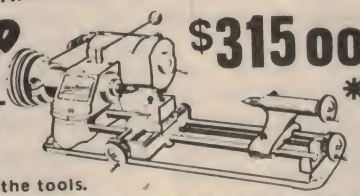

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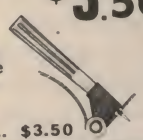

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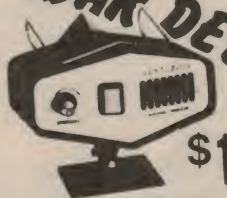

In normal circumstances , detects police radar beams at around twice the distance at which they can give a reliable reading of your speed. The unit has two mounts, either on the dash of on the sun visor. It is powered by the car battery and can be installed into the loom or can be plugged into the cigar lighter (plug supplied fitted). Two alarms let you know that your picture is about to be taken.
Cat. A-8502 .. .. $115.00

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REFER EA, May 76

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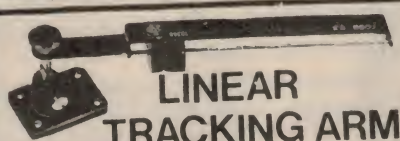

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Cat. C-7065 .. .. $9.75

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The CQ-110E Amateur HF Transceiver

By Roger Harrison, VK2ZTB.

The NEC CQ-110E is fairly representative of modern amateur equipment — a small package with a wide range of facilities and the promise of good performance. Here's our in-depth evaluation.

UNTIL RECENTLY, there were eight main suppliers of HF amateur band transceivers in Australia. Now there are nine! Rank Industries decided to join the fray in 1976, and it appears they are determined to join in at the 'top end' of the market — with the local release of the CQ-110E transceiver made by the Japanese electronics and communications giant, NEC.

The CQ-110E has been available in Europe and USA for over 12 months now and appears to be a popular transceiver in both areas. At first glance, the equipment looks like other modern run-of-the-mill HF amateur transceivers in styling and panel layout but, in many respects, its performance and features belie its initial one-of-the-mob image.

Let's have a general look over it before seeing how it performed on the bench and on the air.

Description And Features

The CQ-110E is a HF amateur band transceiver capable of operating on four modes of transmission and reception, viz: CW (A1), SSB (A3J), AM (A3H) and FSK (F1) — the latter for RTTY, SSTV or FAX. It covers the seven amateur bands, 160 m, 80 m, 40 m, 15 m, 11 m and 10 m, in ten 500 kHz ranges and includes a receive-only range at 15 MHz to cover WWV time and frequency standard transmissions. In addition, VNG Lyndhurst (Victoria) can be covered on the 7-7.5 MHz range.

The transmitter delivers around 100 W PEP output on SSB (rated at 280 W input), and similar carrier power on CW and FSK. Two 6JS6 valves are employed in PA. In addition to a main neutralization adjustment there is a neutralization 'correction' capacitor for each band that ensures proper PA stability and tuning, regardless of which band is selected. On CW, the bias lines to the transmit mixer and driver stages are keyed. Sidetone is included. VOX circuitry is included for SSB or AM operation.

The receiver is a single conversion superhet on SSB and CW, with a 9 MHZ IF and separate crystal filters and carrier insertion oscillators for USB, LSB and CW. On AM, the receiver employs double conversion to 455 kHz where a ceramic mechanical filter is employed. A clarifier control is provided, concentric with the frequency calibration knob.

An IF noise blanker is incorporated and the AGC system has two selectable, time constants. Surprisingly, valves are used in the RF and mixer stages of the receiver front end. This is not so surprising when you consider the performance.

A 6BZ6 pentode is used in the RF amplifier and a 7360 differential beam deflection tube in the mixer. Both of these are noted for their low noise, low crossmodulation (high linearity) characteristics and ability to handle RF signals into the volt region. It is possible to achieve similar performance with solid state circuitry, or even better, but the choice of valves may have been made on the basis of cost or band-switching simplicity.

The basically single-conversion design, together with the high performance mixer, ensures a receiver with low spurious responses.

Digital frequency indication is incorporated, rather than the more usual dial and vernier scale. Seven-segment LED displays are employed with a total of six numerals giving a readout to 100 Hz. A latch circuit eliminates flicker during tuning. Calibration is effected using the usual 100 kHz internal crystal calibrator which may itself be calibrated by zero-beating against a standard frequency transmission such as WWV or VNG. In this way, good readout and reset accuracy can be maintained. Two LEDs indicate when the VFO has been tuned above or below the limits of the 500 kHz tuning range. Some 30 kHz to 50 kHz of overlap is provided.

The transceiver may be powered from 240 V AC or 12 V DC; an internal DC-DC converter is included with the power supply circuitry. Two power leads are included, with sockets attached, the power inlet being a large, heavy duty, multi-pin Cannon connector. Thus, the transceiver is capable of self-contained operation either as a home station or a mobile/portable rig.

The transceiver is supplied complete with handbook, AC and DC power leads, microphone, two 6 mm tip jacks, a set of five RCA plugs, two hex spanners and two spare fuses. These are fairly standard inclusions with most transceivers.

The manufacturer's specifications are listed in the separate box.

Performance

The receiver performance can only be described as outstanding. It is probably one of the best HF amateur receivers on the market. Top marks!

The receiver sensitivity figures indicate quite a low noise figure for this sort of receiver, and there aren't many around to match it as a survey in QST last year showed. The receivers in most equipment built for the amateur market generally have reduced performance on bands above 21 MHz but the CQ-110E maintains its sensitivity and noise figure right through to 28 MHz. Negligible variation was found on the other bands. Anyone for meteor scatter on 28 MHz?

It would make an excellent 'tuneable IF' receiver for VHF/UHF converters or transverter systems.

The measured signal-to-noise ratio on SSB exceeded the specification at 0.3 μV input, as would be expected from the low noise figure. On AM it met the spec, but the measurement conditions are not mentioned in the manufacturer's literature. Again, these results were found to be consistent on all ranges.

The selectivity on SSB and CW was carefully measured and is tabulated with the performance results. As crystal filters are employed there are a number of 'bumps' outside the filters' passband. These were measured to be only 40 dB down, although the nulls adjacent to the filter 'skirts' are some 60 dB down, as are successive nulls further away. Strong signals in closely adjacent channels are thus likely to produce a little 'monkey chatter' in the background — even though the front end may be operating well within its linear range. It was difficult to measure the filter bandwidth at the −60 dB points owing to the narrow, deep nulls. Both filters were somewhat wider than the specification at the −6 dB points. The difference is of small consequence operationally.

The AGC operation is a little short of superb! A delayed AGC characteristic is employed, the AGC commencing to take significant effect on signals above −90 dBm so that full receiver gain is operative on weak signals. The S-meter characteristic closely follows a logarithmic curve as illustrated in Figure 1. The S-point markings are at approximately 3 dB intervals from S1 to S9. The S9+20 mark was found to be only 18 dB above S9. The S9+40 was 57 dB above S9. The S-meter characteristic may be adjusted somewhat to suit your own preference. As it stands, up to S9+20, the S-meter gives 'generous' readings — good for your ego and the DX's. Beyond that, it is quite 'scotch'. This is probably a good thing. You can give generous reports to the DX etc, but the bloke two blocks away probably won't pin your S-meter. Keep him guessing; Heh, heh, heh!

The dynamic range of this receiver puts it head and shoulders above most other amateur HF band receivers, or transceiver/receiver composites. Output compression (indicating the commencement of non-linearity) commences at +14 dBm, which is a little over one volt into the antenna terminals! That's about 25 mW, if you look at it another way.

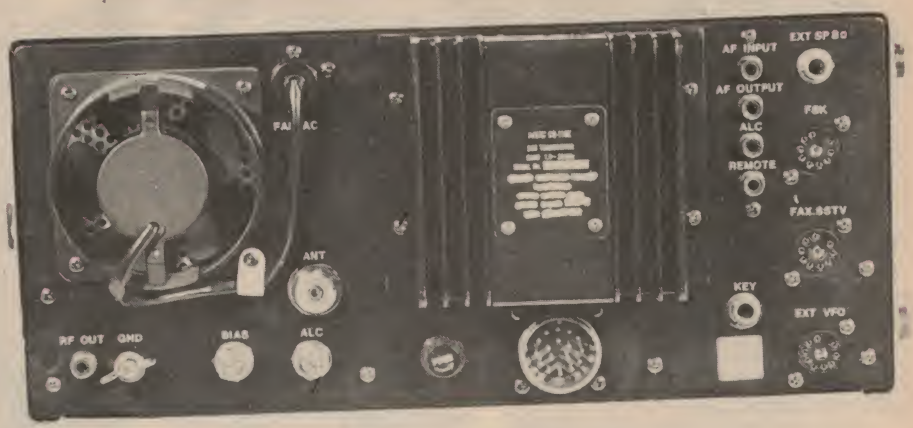
Crossmodulation? What crossmodulation?

The image rejection and IF rejection more than adequate for the job.

I very carefully tuned across each 500 kHz segment but no spurious signals were evident.

Stability on transmit or receive was excellent, as the test figures show. The drift curve for the warm-up test is illustrated in Figure 2. The specification gives a figure of 'less than 2 kHz' which seems an excessively large figure. In fact, there would be cause for alarm if the stability ever approached the specification. Unfortunately, the readout drifts more than the rest of the transceiver oscillators combined. However, it was generally found to be within plus or minus 200 Hz of the actual frequency.

The front panel sports a full complement of controls in the familiar format...



...while the rear panel carries a full complement of connectors.

The transmitter however, is rather more run-of-the-mill. Nevertheless, it performs the job adequately. Power output on SSB was measured at 110 W PEP, and the rig produces the same power on CW. Carrier power output on AM is considerably reduced, naturally, so that the PA valves operate within ratings, but this was not measured. The manufacturer specifies the AM input as 80 W, so around 30-40 W carrier output could be expected on AM.

The transmitter did not meet the specification with respect to spurious emissions, which is quoted as being −40 dB or better. The second harmonic was only 16 dB down, the third only −32 dB, which is somewhat alarming. The use of a low pass filter to prevent TVI, and an antenna tuner for each band, would be necessary to avoid any troubles from radiated harmonics. Note that this may have been a problem only with the particular transceiver submitted. If you can't check it yourself (a Hewlett-Packard HP8553B spectrum analyser comes in handy in the shack!), then do the safe thing. All other spurii were greater than −56 dB which is quite adequate.

The carrier suppression and opposite sideband suppression did not meet the spec of −50 dB or better. However, the measured results of −42 dB and −45 dB are reasonable — and many transceivers on the market are similar.

Comments

We have good news and bad news . . . as ▶ the joke goes.

CQ-110E Amateur HF Transceiver

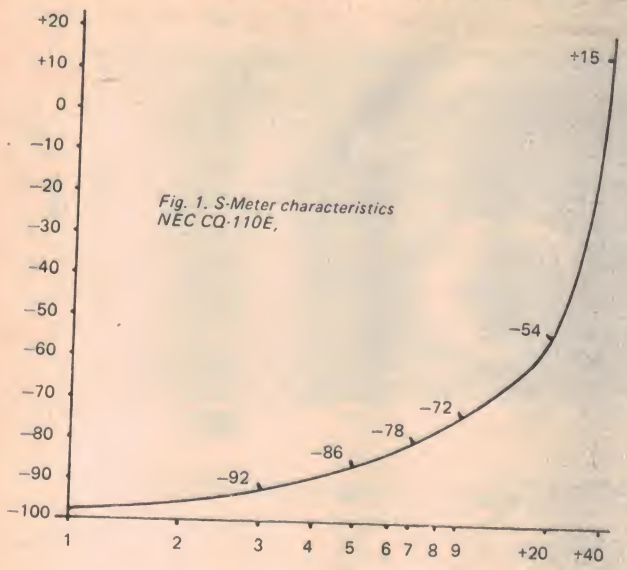


Fig. 1. S-Meter characteristics NEC CQ-110E.

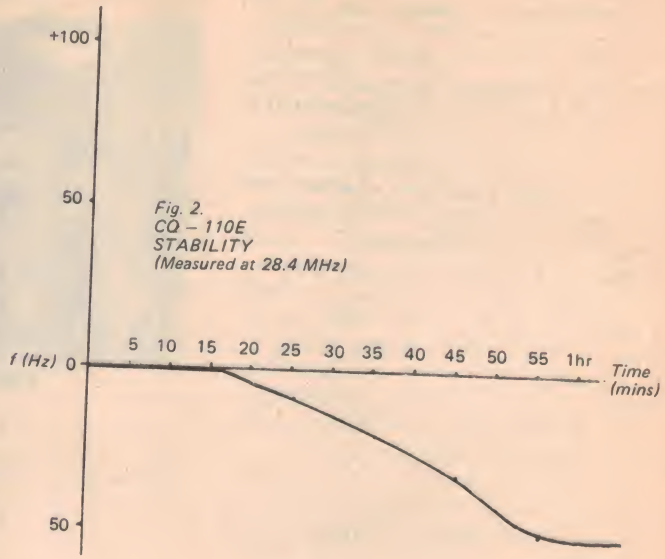


Fig. 2. CQ – 110E STABILITY (Measured at 28.4 MHz)

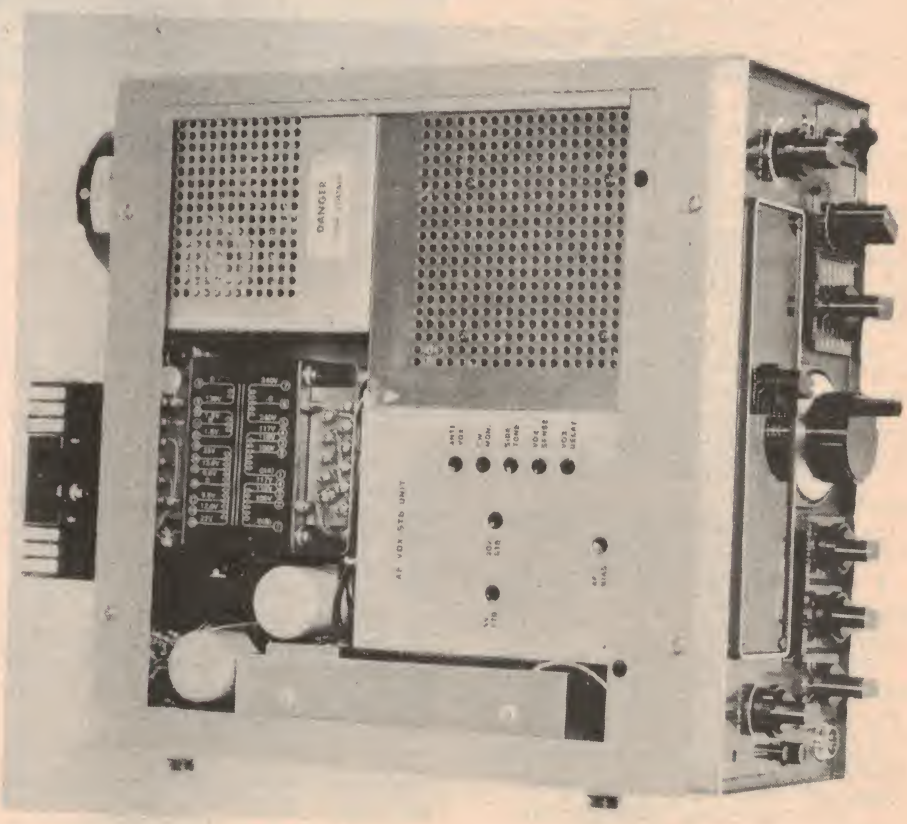
The receiver is excellent. You would probably pay almost the same price as you do for this transceiver for a HF receiver alone with similar performance. For today's crowded band conditions a receiver must be able to handle the strong next door to the weak – and remain unconcerned. Dynamic range is one of the most important features. The CQ-110E certainly delivers that. Its weak signal capability also is all that one could ask – it is possible to do better, but only marginally so. Stability and selectivity leave little to be desired. The tuning rate is somewhat 'slow' to my taste (feel?) however.

I found the front panel controls somewhat cramped. When operating the audio or RF gain I tended to knock the mic gain (the way the controls are situated the mic gain usually got reduced!). Similarly, when operating the mode switch I would either knock the audio gain or the RF gain, or sometimes both! The CAL control is a trap when 'knobtwiddlers' are in the shack. However, on the plus side, the VFO knob is quite clear and of a good size. It is conveniently fitted with a crank for rapid band tuning or frequency changing. A convenient feature is the on/off button for the FINE, or clarifier, control. You can set the clarifier for a fixed receiver offset and then return to your transmitting frequency without the necessity of adjusting the clarifier each time you wish to change.

On the air, the rig performs quite well and is easy to use, with the exception of the cramped controls. One disturbing feature is the level of hum on the signal. On close examination of the signal it appeared to be both on the audio and FM modulating the carrier. It was quite noticeable on a strong signal. Apart from that, audio quality was quite good with an adequate balance between highs and lows.

Unfortunately, the equipment and time was not available to check the rig

Inside the cabinet, the transceiver appears to be very well built, although a lot of circuitry is crammed into that cabinet. Servicing would present some difficulties. However, the local representative assured me that excellent service facilities are available – with amateurs on the staff.



The innards of the rig are solidly constructed and well screened.

A disadvantage I can see with fully digital readouts is that if a fault develops in the display circuitry you're lost. However, considering the realibility of digital circuitry, I don't think this is very serious.

Before concluding I must include comments on some discussions and tests I had with Dick Norman, VK2BDN. He has possessed a CQ-110E for more than a year, having obtained one from Japan not long after they were first released.

The audio distortion on reception from Dick's rig was markedly worse than the rig submitted for review. The hum modulation on the transmitted signal was about the same from both transceivers. This latter appeared to be due to earth-loop problems. Dick obtained another audio board for his rig but it too had the same distortion problem. His rig developed a fault in the readout circuitry and he had a great deal of difficulty repairing it — even with expert help. Dick had already noted difficulties with the cramped controls.

Another difficulty Dick experienced was RF feedback via the mic leads and input socket when the transceiver was used in conjunction with a linear. This was cured with appropriate shielding and bypassing. This sort of thing is more omission than a major fault. The manufacturer should anticipate that a transceiver of this sort will be used with a linear amplifier.

There were other criticisms but those mentioned were the main ones.

The local representative noted that the audio distortion and hum on transmission appeared to be substantially improved in more recent equipment. This has not been verified by the reviewer.

In summary, it appears that the CQ-110E is quite a good transceiver, somewhat above the run-of-the-mill in features and some performance aspects. It has its faults, but I would say that they largely compare with similar transceivers. Overall, the CQ-110E, with local sales and service organisation, appears to be a strong contender in the top end of the amateur transceiver market.

NEC CQ-110E AMATEUR HF TRANSCEIVER MANUFACTURER'S SPECIFICATIONS

Modes	SSB (USB,LSB); AM; CW and FSK.
Frequency Ranges	160 m (1.5 – 2.0 MHz) 80 m (3.5 – 4.0 MHz) 40 m (7.0 – 7.5 MHz) 20 m (14.0 – 14.5 MHz) 15 m (21.0 – 21.5 MHz) 11 m (27.0 – 27.5 MHz) 10 m,A (18.0 – 28.5 MHz) 10 m,B (28.5 – 29.0 MHz) 10 m,C (29.0 – 29.5 MHz) 10 m,D (29.5 – 30.0 MHz) WWV,JJY (15.0 – 15.5 MHz)
Frequency Stability	2 kHz or below for warm up; 100 Hz or below 30 minutes after warm-up.
Antenna Impedance	50–100 ohm unbalanced
Maximum Input	SSB, CW DC input: 280 W (240 W on 28 MHz) AM DC input: 80 W
Carrier Suppression	50 dB or greater
Opposite Sideband Suppression	50 dB or greater (at 1 kHz)
Spurious Emissions	–40 dB or less
3rd Order Distortion (Intermodulation)	26 dB or more (to one or two signals)
Selectivity	SSB; CW: 0.6 kHz (–6 dB) 1.6 kHz (–60 dB) AM: 2.4 kHz (–6 dB) 4.5 kHz (–60 dB) *note that this is probably a typographical error in the manual. Logically, the figure given for AM would appear to be the SSB selectivity.
Sensitivity	SSB, CW: 0.3 μV for S/N of 10 dB or more AM: 1 μV for S/N of 6 dB or more
IF Rejection	– 60 dB or greater
Image Rejection	–60 dB or more
Internal spurious responses	1 μV or less
AF Output	3 W at 10% distortion
AF Output Impedance	8 ohm
Power Consumption	Receive: 70 W or less 50 W or less with heaters off Transmit: 320 W or less 120 W or less with heaters off
Dimensions	334 mm width x 322 mm depth x 153 mm height
Weight	18 kg

NEC CQ-110E AMATEUR HF TRANSCEIVER MEASURED CHARACTERISTICS

RECEIVER	
Sensitivity	Noise Floor = –136 dBm Minimum Detectable Signal = 133dBm (0.05 μV) (CW, 2.5 kHz bandwidth) *Measured on 14 & 28 MHz
Signal to Noise Ratios	SSB, 0.3 μV input = 16 dB (S+N/N) (single tone) AM, 1 μV input = 6 dB (modulation: 400 Hz @ 30%) *Measured on 14 & 28 MHz
Selectivity	SSB = 2.5 kHz @ –6 dB; 3.5 kHz @ –40 dB CW = 800 Hz @ –6 dB; 1.4 kHz @ –40 dB Bandpass ripple: SSB = 1.5 dB peak-peak; CW = 1.2 dB peak-peak; Minimum Stopband Attenuation = –40 dB
AGC Characteristics	Less than 4 dB change in audio output between –100 dBm and +10 dBm S-meter characteristics : S1 = –98 dBm (2.8 uV) S9+20 = –54 dBm (440 mV) *Approx 3 dB per S-point up to S9 (see graph)
Dynamic Range	Output compression commences at +14 dBm (SSB, single tone), this is just over 1 V at the antenna terminal.
Crossmodulation	No crossmodulation was evident on a – 90 dBm signal with a modulated +10 dBm signal offset 10 kHz in frequency.
Image Rejection	Greater than –70 dB (measured on 14 & 28 MHz)
IF Rejection	Greater than –90 dB (measured on 14 & 28 MHz)
Internal Spurious Responses	None detected, thus they would be less than –133 dBm at input.
Stability (Tx or Rx)	Measured drift of –50 Hz from warm up to 1 hour later (see graph). Environment temperature was stable to within +/– 2°C; transmitter filaments were switched on. This degrades to about –200 Hz if Tx filaments left off. Readout was within +/– 200 Hz of actual frequency.
TRANSMITTER	
Power Output	SSB = 110 W PEP (single tone or two tone) CW = 110 W (RMS) AM = not measured (see text) The power output varied less than 10 W over all bands.
Spurious Emissions	2nd Harmonic = –16 dB, relative to fundamental 3rd Harmonic = –32 dB, relative to fundamental Other = greater than –56 dB
Carrier Suppression	Measured –42 dB minimum
Opposite Sideband Suppression	Measured –45 dB minimum
Intermodulation Distortion	Not measured *See text for comments on hum modulation
POWER CONSUMPTION	Power consumption on transmit was a fraction over 300 VA on 240 V AC and a little over 27 amps on 12.6 V (about 345 watts). On receive, it was a little under 70 VA on 240 V AC and about 6A on 12.6 V with Tx heaters on; about 4 A with heaters off.

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7423	.29	7492	.48	74171	.84
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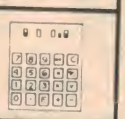

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DATA SHEETS EXPLAINED

The data sheets which we publish regularly are very popular, but from time to time we receive requests for a fairly simple explanation of the terms and abbreviations which one finds in semiconductor device data sheets. This article has been prepared to satisfy your requests. **by Brian Dance**

THE INFORMATION contained in semiconductor device data sheets is often grossly misunderstood. Great care must be taken to ensure that the exact meaning of a term or abbreviation is clear. As an example, we can quote the following conversation which actually occurred between two people who should both have known better.

A representative of a semiconductor distributor was showing data on a new power device to a lecturer. The lecturer said that the device data was wrong, since the maximum collector current was quoted as 12A and the maximum collector-emitter voltage (V_{CEO}) as 80V; this is a power level of 12 x 80 = 960W, but the maximum permissible dissipation quoted in the data sheet is only 90W. The representative could provide no answer!

The data was, of course, perfectly correct. The problem arose because neither of the people concerned had appreciated the exact meaning of V_{CEO} which signifies the collector-emitter voltage *with the base open circuited*. Under these conditions (with zero base current) the collector current will be very small and the power dissipation in the transistor will also be quite small. Thus there is a great deal of difference between V_{CE} (the collector-emitter voltage under any conditions) and V_{CEO} (the collector-emitter voltage with the base open circuited). If still more information is required, one must look into the SOAR (Safe Operating ARea) graph to ascertain the regions of the collector voltage/collector current curve where the device can be safely operated for limited or unlimited times.

This is a very simple example of the pitfalls one can encounter if ones does not really understand the *exact* meanings of the terms and abbreviations used in data sheets. Such misunderstandings are very common, but not (we hope!) amongst the devices covered in our data sheets, since it is equally important that our readers understand the exact meanings of abbreviations used in data sheets on relatively simple devices such as ordinary diodes and transistors.

LETTER SYMBOLS

Three of the most important symbols used in semiconductor device data sheets are V, I and P for voltage, current and power respectively. Various subscripts are added to these three letters to indicate the electrode(s) to which the symbol is being applied and possibly certain circuit conditions. Some of the most commonly used subscripts are listed below.

A	anode
AV	average
B	base
BO	breakover
BR	breakdown
C	collector
D	drain or delay
E	emitter
F	forward
G	gate
H	holding
I	input
J	junction
K	cathode
M	peak value of a quantity
O	open circuit or output
R	reverse or repetitive
S	source, short circuit, series or shield
T	in the on state (that is, triggered)
W	working
X	specified circuit
Z	regulator impedance

CAPITALS AND LOWER CASE Both the quantity being shown and the subscript may appear as a capital or lower case letter in order to differentiate between instantaneous and rms values. The basic rules are given in the following table:

	MEANING
Capital quantity symbol plus capital subscript [V,I,P] + [C,E,B]	The steady current (no signal) value. The subscript (AV) may be added to indicate the total average value with signal or (M) for the total peak value.
Capital quantity symbol plus lower case subscript [V,I,P] + [c,e,b]	The rms value of the alternating signal component. The subscript (av) may be added to indicate the average value of the varying signal component or (m) to indicate the peak value of this component.
Lower case quantity symbol plus capital subscript [v,i,p] + [C,E,B]	The instantaneous total value of the quantity concerned.
Lower case quantity symbol plus lower case subscript [v,i,p] + [c,e,b]	The instantaneous value of the varying signal component.

DATA SHEETS EXPLAINED

Thus i_E is the instantaneous value of the total emitter current, i_e the instantaneous value of the alternating component of the emitter current, and $I_{E(AV)}$ the average (dc) value of the total emitter current. Other subscripts can be used in a similar way, I_F being the forward dc current with no signal, i_F the instantaneous forward current and I_{FM} the peak forward current.

ORDER OF SUBSCRIPTS

In most cases more than one subscript is needed; the subscripts are usually placed in a definite order governed by the following rules:

The first subscript indicates the electrode at which the current or voltage is measured.

The second subscript denotes the reference terminal or circuit mode. (This subscript is often omitted if it is felt no ambiguity will arise.)

The letter O may be used as a third subscript to show that the electrode not indicated by any previous subscript is open circuited. Similarly the letter S can be used as a third subscript to show the third electrode is shorted to the reference electrode of the second subscript, whilst the letter R as a third subscript indicates that a specified resistance is connected between the third electrode and the reference electrode.

The supply voltage to a collector is indicated as V_{CC}, the second suffix being a repetition of the first in the case of supply voltages. Similarly, one often meets the symbol V_{DD} for the positive supply to a CMOS (or COS/MOS) device, this being the supply to the drain. The negative supply to CMOS devices is normally represented by the symbol V_{SS}.

It should now be clear why V_{CEO} is the steady collector-emitter voltage with the base open circuited. Similarly I_{CER} is the collector cut off current with a specified resistance between the base and emitter. It is current with the base and emitter joined, since either the base or emitter can be used as the reference electrode without any change when they are joined.

The parameters of individual devices vary from one device to another of the same type number. The typical value of a parameter such as transistor current gain is often quoted in data sheets by the abbreviation 'typ' after the quantity, but minimum and maximum values are also often quoted. In economical devices no maximum and minimum values may be quoted. In the case of breakdown voltages, the minimum value applicable to any device of that type number is usually quoted so that the circuit designer knows that he can apply that value of voltage without danger of the device junction breaking down.

The above discussion gives the general principles of the way in which the symbols for various parameters are chosen. It is not complete, since we have not yet covered such items as current gain of a transistor or thermal characteristics of a device. However, these and other quantities will be covered in the following tables.

THERMAL CHARACTERISTICS

The symbols used for the following thermal quantities apply to all types of semiconductor device.

P_{tot}	total power dissipated within the device
T_{amb}	ambient temperature
T_c	temperature of the case of the device
T_j	temperature of the junction in the semiconductor material
T_{mb}	temperature of the mounting base of the device (= T_c)
T_{stg}	storage temperature
θ_h	thermal resistance of heat sink. (Units. °C/W)
θ_i	contact thermal resistance between the case of the device and the heat sink
$\theta_{j\text{-amb}}$	junction to ambient thermal resistance
$\theta_{j\text{-c}}$	junction to case thermal resistance

SYMBOLS USED MAINLY WITH DIODES

C_d	diode capacitance with reverse bias
C_f	diode capacitance with forward bias
C_j	capacitance of the junction itself
C_{min}	minimum capacitance (which occurs at the rated breakdown voltage)
C_o	diode capacitance at zero bias
f_{co}	cut off frequency of a varactor diode
I_F	total dc forward current
i_F	instantaneous forward current
$I_{F(AV)}$	average forward current
I_{FM}	peak forward current
I_{FRM}	repetitive peak forward current
I_{FSM}	non-repetitive peak forward current occurring under surge conditions
I_R	continuous reverse leakage current
i_R	instantaneous reverse leakage current
I_{RRM}	repetitive peak reverse current
I_{RSM}	non-repetitive peak reverse current
I_Z	zener diode continuous operating current
I_{ZM}	zener diode peak current
t_{on}	turn on time
t_{off}	turn off time
t_r	rise time
t_{rr}	reverse recovery time
t_s	storage time
V_F	steady forward voltage
v_F	instantaneous forward voltage
V_R	steady reverse voltage
v_R	instantaneous value of the reverse voltage
V_{RM}	peak reverse voltage
V_{RRM}	repetitive peak reverse voltage
V_{RSM}	non-repetitive peak reverse voltage (on surges)
V_Z	zener diode working voltage

SYMBOLS USED MAINLY WITH TRANSISTORS

C_{ob}	transistor output capacitance in the grounded base circuit
C_{oe}	transistor output capacitance in the grounded emitter circuit
f_T	transition frequency or gain-bandwidth product in common emitter circuit
h_{FE} (h_{FB}, h_{FC})	current gain in the grounded emitter circuit (or in the grounded base or grounded collector circuit).
h_{fe}	the increase in collector current divided by the small increase in the base current which produces it. (Small signal current gain.)
I_B, I_C or I_E	the steady base, collector or emitter current.
$I_{B(AV)}$, $I_{C(AV)}$ or $I_{E(AV)}$	the average value of the base, collector or emitter current.

I_{CEX} collector cut off current in a specified circuit

I_{CM}, I_{BM} or I_{EM} peak value of collector, base or emitter current

I_b, I_c or I_e rms value of the alternating component of the current

I_{bm}, I_{cm} or I_{em} peak value of the alternating component of the current

i_C, i_B or i_E instantaneous value of the total current

i_c, i_b or i_e instantaneous value of the alternating component of the current

I_{CBO} collector cut off current with the emitter open circuited

I_{CBS} or I_{CES} collector cut off current with emitter shorted to the base

I_{CEO} collector cut off current with the base open circuited

I_{CER} collector cut off current with a specified value of resistance between the base and the emitter

I_{EBO} emitter cut off current with the collector open circuited

$V_{BE(SAT)}$ base-emitter saturation voltage

$V_{(BR)}$ breakdown voltage

$V_{(BR)CBO}$ collector to base breakdown voltage with emitter open circuited

$V_{(BR)CEO}$ collector to emitter breakdown voltage with base open circuited

V_{CB} collector-base voltage

V_{CBO} collector to base voltage with emitter open circuited

V_{CC} collector supply voltage

V_{CE} collector to emitter voltage

V_{CEO} collector to emitter voltage with base open circuited

V_{ce} collector to emitter rms voltage

$V_{CE(SAT)}$ collector to emitter saturation voltage

V_{EB} emitter-base voltage

V_{EBO} emitter-base voltage with collector open circuited

V_{eb} emitter-base rms voltage

SYMBOLS USED MAINLY WITH FETS

I_D steady value of the drain current

I_{DSS} steady value of the drain current with the gate connected to the source

I_{DM} peak drain current

I_G steady gate current

I_S steady source current

r_{DS} drain to source (or channel) resistance

V_{DS} steady drain to source voltage

V_{GS} steady gate to source voltage

SYMBOLS USED MAINLY WITH THYRISTORS

I_{FRM} repetitive peak forward current

I_{FSM} non-repetitive peak (surge) current

I_{GD} gate current which does not trigger the device

I_{GT} gate trigger current

I_{GQ} gate turn off current

I_H holding current required to maintain conduction

I_R steady reverse leakage current

I_{RG} reverse gate current

I_{RRM} repetitive peak reverse current

I_{RSM} non-repetitive peak reverse current (in surge conditions)

I_T steady anode-cathode 'ON' state current

P_G gate power

t_{gt} gate controlled turn-on time

t_{gq} gate controlled turn-off time

$V_{(BO)}$ breakover voltage

V_D continuous off state voltage

V_{FG} forward gate voltage

V_{GT} gate trigger voltage

V_R steady reverse voltage

OPERATIONAL AMPLIFIER TERMS

Bandwidth, $\triangle f$. The frequency at which the gain falls by a factor of 0.7 relative to the gain at low frequencies.

Common mode rejection ratio, CMMR. The gain when a signal is applied to one of the inputs of the amplifier divided by the gain when the signal is applied to both the inverting and non-inverting inputs. It is usually expressed in dB.

Frequency compensation. An operational amplifier requires a capacitor to enable it to be used in circuits which are stable over a wide frequency range. Internally compensated operational amplifiers have this capacitor fabricated on the silicon chip, but an external capacitor must be used with other types of operational amplifier which do not contain an internal capacitor

Input bias current, I_{bias}. The mean value of the currents at the two inputs of an operational amplifier.

Input offset current, I_{OS}. The difference in the two currents to the inputs of an operational amplifier. Normally much smaller than the input bias current.

Input offset voltage, V_{OS}. The voltage which must be applied between the two input terminals through equal resistors to obtain zero voltage at the output.

Open loop voltage gain, A_{VOL}. The amplifier gain with no feedback applied.

Output resistance, R_O. The small signal resistance seen at the output when the output voltage is near zero.

VOLTAGE REGULATOR TERMS

Dropout voltage, V_{DO}. When the difference between the input and output voltages falls down below the dropout voltage, the device ceases to provide regulation.

Foldback current limiting. In regulators with foldback current limiting, the current will 'fold back' to a fairly small value when the output is shorted.

Line regulation. The change in the output voltage for a specified change in the input voltage.

Load regulation. The change in output voltage for a change in the load current at a constant chip temperature.

Quiescent current, I_Q. The current taken by the regulator device when it is not delivering any output current.

Ripple rejection. The ratio of the peak-to-peak ripple at the input of the regulator to that at the output. Normally expressed in dB.

MONOLITHIC TIMER TERMS

Comparator input current. The mean current flowing in the comparator input connection during a timing cycle.

Timing capacitor, C_t. This capacitor is normally connected between the comparator input and ground. The time taken for it to charge controls the delay time.

Timing resistor, R_t. This is the resistor through which the timing capacitor charges.

Trigger current. The current flowing in the trigger input connection, at the specified trigger voltage.

Trigger voltage. The voltage required at the trigger pin to initiate a timing cycle.

Conclusions

Data sheets must be used intelligently and with much thought. Information on the conditions under which an entry in the data sheet is applicable is often stated in small print, but is of great importance. Data should always be thoroughly studied before a device is used for the first time; only then will you be able to fully understand the potential applications of the device.

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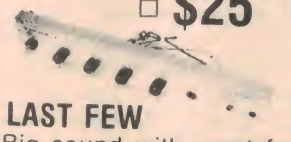

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Covers 160 meters with accessory crystal. In addition to the ham bands, tunes any fifteen 500 kHz ranges between 1.5 and 30 MHz, 5.0 to 6.0 MHz not recommended. Can be used for MARS, WWV, CB, Marine and Shortwave broadcasts.

Superior selectivity: 2.4 kHz 8-pole filter provided in ssb positions. 8.0 kHz, 6 pole selectivity for a-m. Optional 8-pole filters of .25, .5, 1.5 and 6.0 kHz bandwidths available.

Tunable notch filter attenuates carriers within passband.

Smooth and precise passband tuning.

Transceive capability; may be used to transceive with the T-4X, T-4XB or T-4XC Transmitters. Illuminated dial shows which PTO is in use.

Usb, lsb, a-m and cw on all bands.

Agc with fast attack and two release times for ssb and a-m or fast release for break-in cw. Agc also may be switched off.

New high efficiency accessory noise blanker that operates in all modes.

Crystal lattice filter in first i-f prevents cross-modulation and desensitization due to strong adjacent channel signals.

Excellent overload and intermodulation characteristics.

25 kHz Calibrator permits working closer to band edges and segments.

Scratch resistant epoxy paint finish.

$685.00

Drake T-4XC

Solid State Linear permeability-tuned VFO with 1 kHz dial divisions. Gear driven dual circular dials. High mechanical, electrical and temperature stability.

Covers ham bands with crystals furnished. Covers all of 80, 40, 20 and 15 meters, and 28.5-29.0 MHz of 10 meters.

Covers 160 meters with accessory crystal. Four 500 kHz ranges in addition to the ham bands plus one fixed-frequency range can be switch-selected from the front panel.

Two 8-pole crystal lattice filters for sideband selection.

Transceives with the R-4, R-4A, R-4B, R-4C and SPR-4 Receivers. Switch on the T-4XC selects frequency control by receiver or transmitter PTO or independently. Illuminated dial shows which PTO is in use.

Usb, lsb, a-m and cw on all bands.

Controlled-carrier modulation for a-m is compatible with ssb linear amplifiers.

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Meter reads relative output or plate current with switch on load control.

Built-in cw sidetone.

Spotting function for easy zero-beating.

Easily adaptable to RTTY, either fsk or afsk.

Compact size; rugged construction. Scratch resistant epoxy paint finish.

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Drake SSR-1

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- **Low Cost**
- **Selectable Sidebands**
- **All Solid State**
- **Built-in Ac Power Supply**
- **Excellent Performance**

The SSR-1 Receiver provides precision tuning over the short wave spectrum of 0.5 to 30 MHz with capability of reception of a-m (amplitude modulated), cw (continuous wave) and ssb (upper and lower single side band) signals.

A synthesized/drift-cancelling 1st mixer injection system giving thirty tunable ranges from 0.5 to 30 MHz is derived from a single 10 MHz crystal oscillator providing frequency stability necessary for ssb operation.

A stable low frequency VFO tunes each of the 30 one-MHz ranges with a dial accuracy of better than 5 kHz which is sufficient to locate and identify a station whose frequency is known.

Separate detectors (product and diode) are used to provide for best performance whether listening to ssb or a-m signals. Narrow band selectivity for ssb and wide band selectivity for a-m reception is provided.

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Drake TVI Filters

provide more than 40 dB attenuation at 52 MHz and lower. Protect the TV set from amateur transmitters 6-160 meters.

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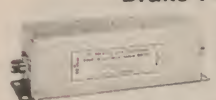
For 300 ohm twin lead **$13.00**

Drake TV-75-HP
For 75 ohm TV coaxial cable; TV type connectors installed
$16.50

Drake TV-3300-LP **$32.00**

1000 watts max. below 30 MHz. Attenuation better than 80 dB above 41 MHz. Helps TV i-f interference, as well as TV front-end problems.

Drake TV-5200-LP **$32.00**



200 watts to 52 MHz. Ideal for six meters. For operation below six meters, use TV-3300-LP or TV-42-LP.

Drake TV-42-LP **$19.00**

is a four section filter designed with 43.2 MHz cut-off and extremely high attenuation in all TV channels for transmitters operating at 30 MHz and lower. Rated 100 watts input.

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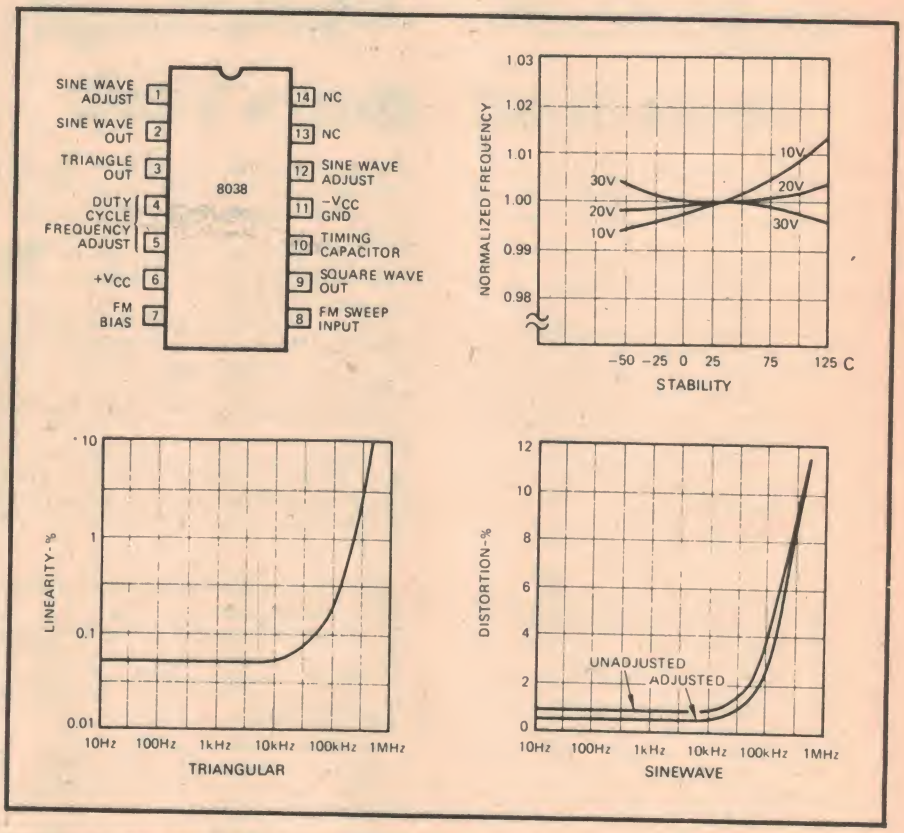
ETI data sheet

INTERSIL ICL 8038
Waveform Generator/V.C.O.

The 8038 has been around for about 5 years — which is a long time in electronics. In fact it has reached the position of becoming an 'Industry Standard' on a par with the 741. An inherently versatile device it has its drawbacks like most chips — but overall has a lot going for it. Intersil even produced a very honest application bulletin (A013) called 'Everything you always wanted to know about the 8038', which explained how to get the best out of this device and admitted its defects — an uncommon event with most manufacturers! Some of the data from A013 has been included in this data sheet, but for more information ask for application bulletins A012, A013, and the latest information sheet. Intersil are distributed in Australia by R & D Electronics Pty. Ltd., 23 Burwood Rd., Burwood, 3125.



Description

The 8038 Waveform Generator is a monolithic integrated circuit, capable of producing sine, square, triangular, sawtooth and pulse waveforms of high accuracy. The frequency (or repetition rate) can be selected externally over a range of less than 1/1000 Hz to more than 1 MHz and is highly stable over a wide temperature and supply voltage range. Frequency modulation and sweeping can be accomplished with an external voltage and the frequency can be programmed digitally through the use of either resistors or capacitors. The Waveform Generator utilizes advanced monolithic technology, such as thin film resistors and Schottky-barrier diodes.

Theory of operation

A block-diagram of the waveform generator is shown in Figure 1. An external capacitor C is charged and discharged by two current sources. Current source #2 is switched on and off by a flip-flop, while current source #1 is on continuously. Assuming that the flip-flop is in a state such that current source #2 is off, then the capacitor is charged with a current I. Thus the voltage across the capacitor rises linearily with time. When this voltage reaches the level of comparator #1 (set at 2/3 of the supply voltage), the flip-flop is triggered, changes states, and releases current source. #2. This current source normally carries a current 2I, thus the capacitor is discharged with a net-current I and the voltage across it drops linearly with time. When it has reached the level of comparator #2 (set at 1/3 of the supply voltage), the flip-flop is triggered into its original state and the cycle starts anew.

Four waveforms are readily obtainable from this basic generator circuit. With the current sources set at I and 2I respectively, the charge and discharge times are equal.

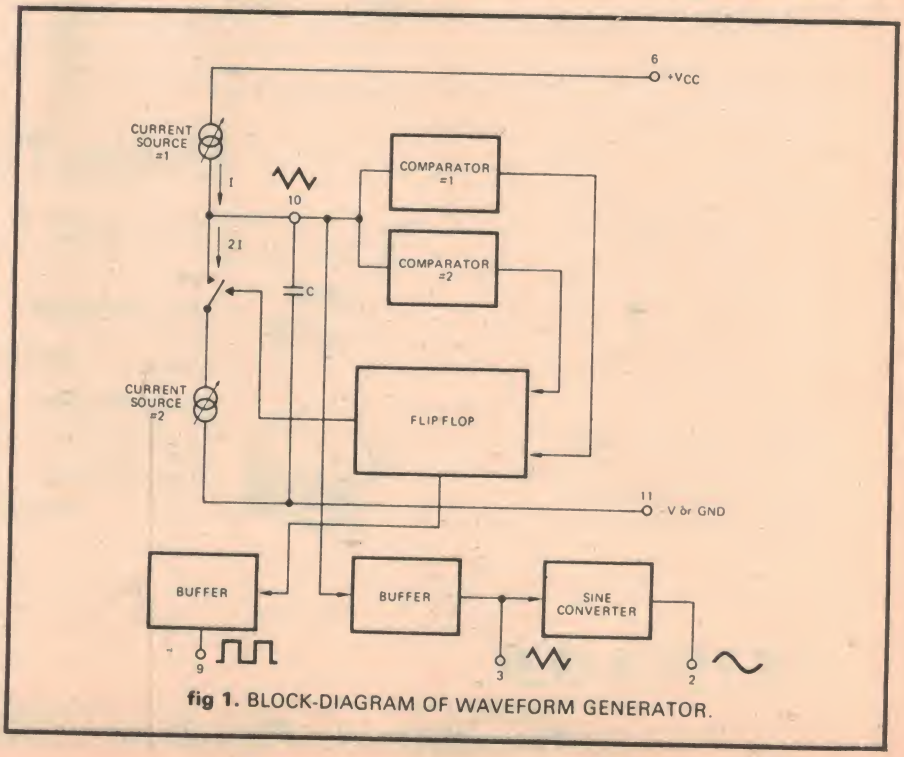


fig 1. BLOCK-DIAGRAM OF WAVEFORM GENERATOR.

Thus a triangle waveform is created across the capacitor and the flip-flop produces a square-wave. Both waveforms are fed to buffer stages and are available at pins 3 and 9.

The levels of the current sources can, however, be selected over a wide range with two external resistors. Therefore, with the two currents set at values different from I and 2I, an asymmetrical sawtooth appears at terminal 3 and pulses with a duty cycle from less than 1% to greater than 99% are available at terminal 9.

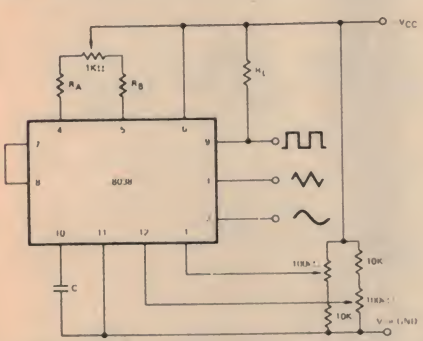
The sine-wave is created by feeding the triangle-wave into a non-linear network (sine-converter). This network provides a decreasing shunt-impedance as the potential of the triangle moves toward the two extremes.

Power Supply

The waveform generator can be operated either from a single power supply (10 to 30 Volts) or a dual power supply (±5 to ±15 Volts). With a single power supply the average levels of the triangle and sine-wave are at exactly one-half of the supply voltage, while the square wave alternates between +V and ground. A split power supply has the advantage that all waveforms move symmetrically about ground.

Also notice that the square wave output is not committed. The load resistor can be connected to a different power supply, as long as the applied voltage remains within the breakdown capability of the waveform generator (30 V). In this way, for example, the square-wave output be made TTL compatible (load resistor connected to +5 Volts) while the waveform generator itself is powered from a much higher voltage.

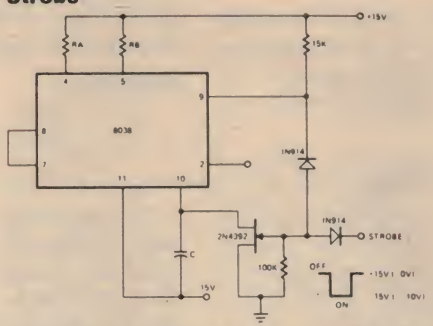
Purity



The symmetry of all waveforms can be adjusted with the external timing resistors. To minimize sine-wave distortion the resistors between pins 11 and 12 are best made variable ones. With this arrangement distortion of less than 1% is achievable. To reduce this even further, two potentiometers can be connected as shown. This configuration allows a reduction of sinewave distortion close to 0.5%.

Both the sine-wave and triangular outputs, are only useful up to about 20kHz if a reasonably pure signal is required. A perusal of the graphs will show why.

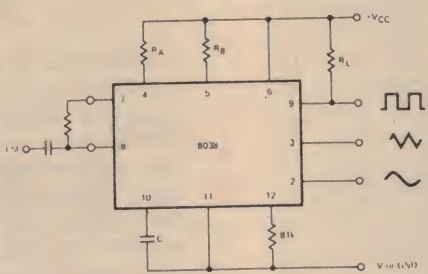
Strobe



With a dual supply voltage (e.g., ±15V) the external capacitor (pin 10) can be shorted to ground so that the sine wave and triangle wave always begin at a zero crossing point. Random switching has a 50/50 chance of starting on a positive or negative slope. A simple AND gate using pin 9 will allow the strobe to act only on one slope or the other.

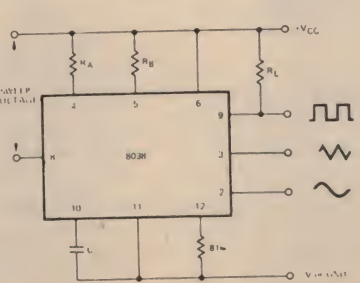
Using only a single supply, the capacitor (pin 10) can be switched either to V+ or ground to force the comparator to set in either the charge or discharge mode. The disadvantage of this technique is that the beginning cycle of the next burst will be 30% longer than the normal cycle.

F.M. and Sweeping



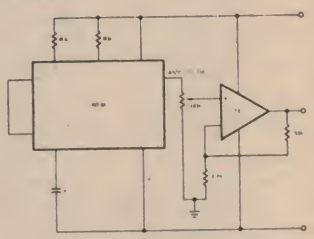
The frequency of the waveform generator is a direct function of the DC voltage at terminal 8 (measured from +VCC). Thus by altering this voltage, frequency modulation is achieved.

For small deviations (i.e. ±10%) the modulating signal can be applied directly to pin 8, merely providing dc decoupling with a capacitor. An external resistor between pins 7 and 8 is not necessary, but it can be used to increase input impedance. Without it (i.e. terminals 7 and 8 connected together), the input impedance is 8k, with it, this impedance increases to (R+8k).



For larger FM deviations or for frequency sweeping, the modulating signal is applied between the positive supply voltage and pin 8. In this way the entire bias for the current sources is created by the modulating signal and a very large (e.g. 1000:1) sweep range is created (f = 0 at V_{sweep} = 0). Care must be taken, however, to regulate the supply voltage; in this configuration the charge current is no longer a function of the supply voltage (yet the trigger thresholds still are) and thus the frequency becomes dependent on the supply voltage. The potential on pin 8 may be swept from V_{CC} to about 2/3 V_{CC}.

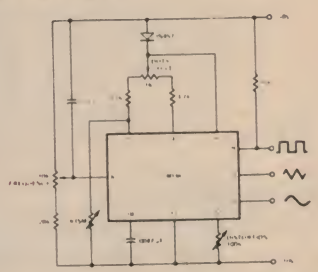
Buffering



The sine wave output has a relatively high output impedance (1K Typ). The circuit provides buffering, gain and amplitude adjustment. A simple op amp follower could also be used.

If the available outputs are all fed through a buffer, extra resistors can be inserted in series with the signal before a switch. Values of 47k (square wave), 15k (triangular) and 10k (sine wave) will ensure equal amplitude signals.

Audio Oscillator



To obtain a 1000:1 Sweep Range on the 8038 the voltage across external resistors RA and RB must decrease to nearly zero. This requires that the highest voltage on control Pin 8 exceed the voltage at the top of RA and RB by a few hundred millivolts.

The Circuit achieves this by using a diode to lower the effective supply voltage on the 8038. The large resistor on pin 5 helps reduce duty cycle variations with sweep. The range of this circuit is 20Hz to 20 kHz, output buffer can be added to make a general purpose bench unit.

Points to Note!

The 8038 runs hot to touch, this is normal, and is due to the resistive nature of the sinewave shaping network.

The optimum supply voltage, for minimum temperature drift is 20V, this can be seen in the stability graph.

ETI data sheet

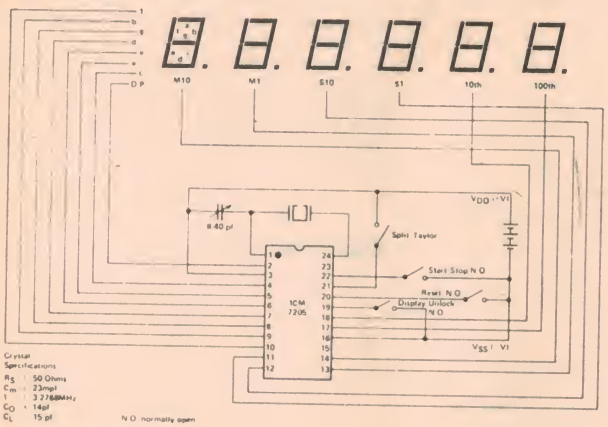
ICM 7205 Stopwatch Chip

The Intersil ICM 7205 is a relatively new device, the main points of interest being: on-chip display drivers, full protection against static – no special handling precautions are required –, and an average current when in operation (including display!) of only 10 mA.

The ICM 7205 is a fully-integrated CMOS six digit stopwatch circuit. The circuit interfaces directly with a six digit/seven segment common cathode LED display. The low battery indicator can be connected directly to the decimal point anode or to a separate LED lamp. The only components required for a complete stopwatch besides the display are: three SPST switches, a 3.2768 MHz crystal, a trimming capacitor, three AA batteries, and an on/off switch. For a two function stopwatch, one additional switch would be required.

The circuit divides the oscillator frequency by 2^{15} to obtain 100 Hz which is fed to the fractional seconds, seconds and minutes counters. An intermediate frequency is used to obtain the 1/6 duty cycle 1.07 kHz multiplex waveforms. The blanking logic provides leading zero blanking for seconds and minutes independently of the clock. The ICM7205 is packaged in a 24 lead plastic DIP.

Stopwatch Circuit



Switch Characteristics

The ICM 7205 is designed for use with SPST switches throughout. On the display unlock and reset the characteristics of the switches are unimportant, since the circuit responds to a logic level for any length of time, however short. Switch bounce on these inputs does not need to be specified. The Start/Stop input , however, responds to an edge, and it requires a switch with less than 15 ms of switch bounce. The bounce protection circuitry has been specifically designed to let the circuit respond to the first edge of the signal, so as to preserve the full accuracy of the system.

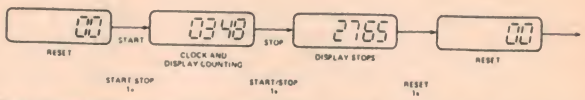
Low Battery Indicator

The on-chip low battery indicator is intended for use with a small LED lamp or with the decimal points on a standard LED display. The output is the drain of a P-channel transistor of approximately half the size of one of the segment drivers. The LBI circuitry is designed always to provide a voltage difference between the LBI trigger voltage and the minimum operating voltage, i.e., the lower the LBI trigger voltage the lower the minimum operating voltage. In this way a stopwatch using three AA batteries will provide at least 15 minutes of accurate timekeeping after the LBI comes on.

Functional Operation

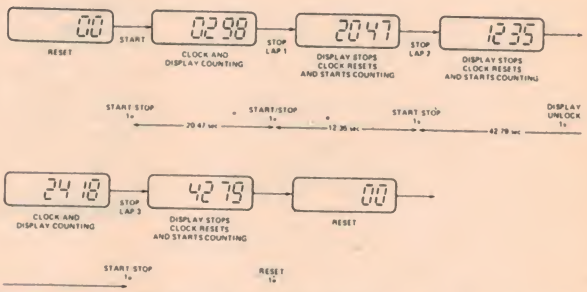
Turning on the stopwatch will bring up the reset state where the fractional seconds are on displaying 00 and the other digits are blanked. This display always indicates that the stopwatch is ready to go.

Start/Stop



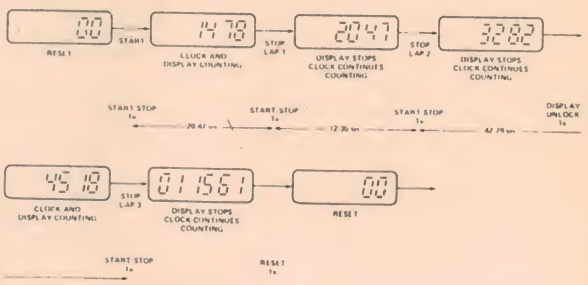
The Start/Stop modes can be used for a single event timing with the Split/Taylor input in either state. The illustration indicates the operations and the results. To time another event the reset switch must be used prior to the start of the event. Seconds will be displayed after one second, minutes after one minute. The range of the stopwatch is 59 minutes 59.99 seconds. If an event exceeds one hour, the number of hours must be remembered by the user. Leading zeros are not blanked after one hour.

Taylor



When the Split/Taylor input is left open circuit or is connected to Vss, the stopwatch can be used in the Taylor or sequential mode. As depicted graphically above, each split time is measured from zero in the Taylor mode, i.e., after stopping the watch, the counters reset to zero momentarily and start counting the next interval. The time displayed is the time elapsed since the last activation of Start/Stop. The display is stationary after the first interval unless the display unlock is used to show the running clock. Reset can be used at any time.

Split

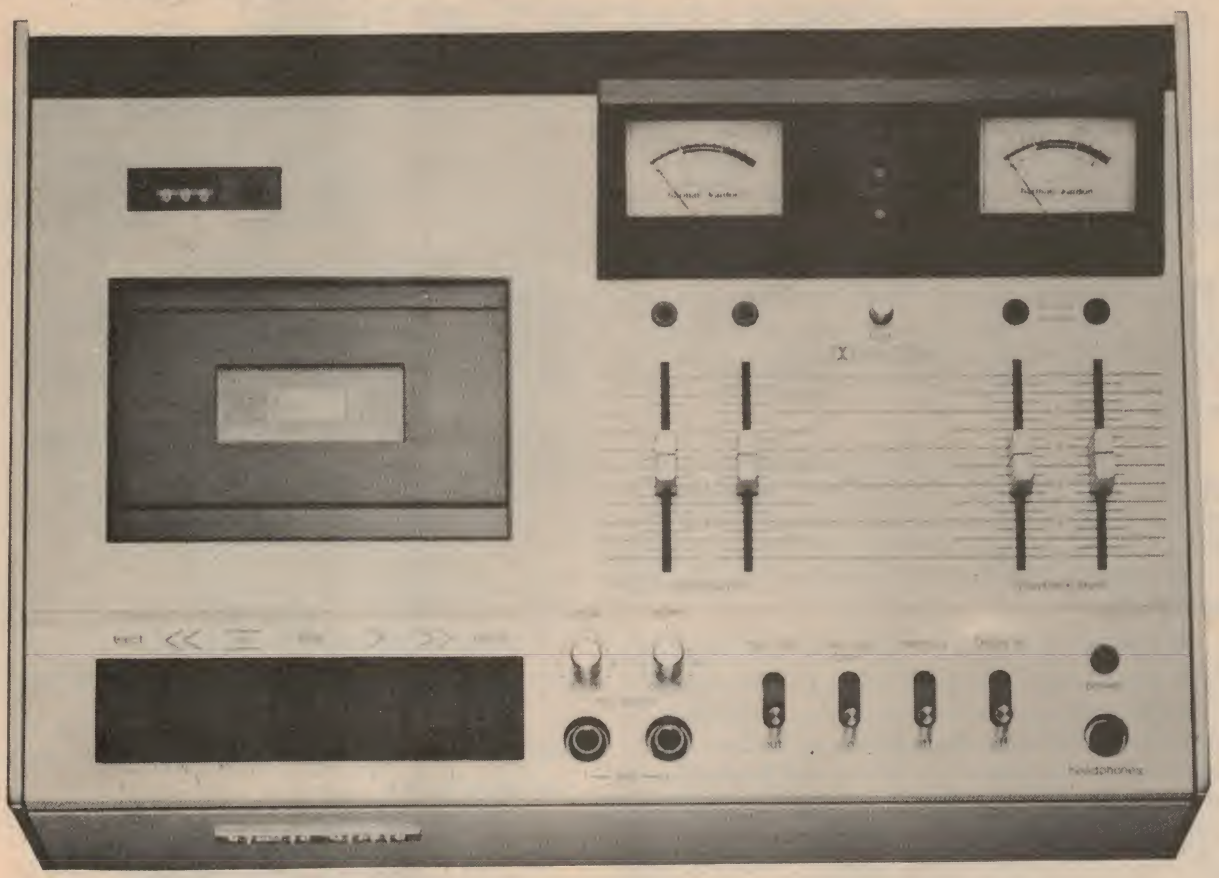


When the Split/Taylor input is connected to VDD the stopwatch is in the Split mode. The Split mode differs from the Taylor in that the lap times are cumulative in the Split mode. The counters do not reset or stop after the first start until reset is activated. Any time displayed is the cumulative time elapsed since the first start after reset. Display unlock can be used to let the display 'catch up' with the clock. Reset can be used at any time.

Points to Note!

Absolute maximum supply voltage is 5V5. Never short outputs to earth or low impedance power supply as this will destroy the device.

The harman/kardon HK2000



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C/MOS

4000	33	4016	58
4001	33	4017	1.33
4002	33	4018	1.33
4006	1.33	4021	1.33
4007	33	4022A	1.33
4008	1.40	4023A	33
4009	64	4024	1.03
4011	33	4027A	63
4012	33	4028A	1.03
4013	55	4030A	58
4014	1.33		

TRANSISTORS

BC547	20	BC640	30
BC548	20	BD139	59
BC549	20	BD140	59
BC559	20	BF180	59
BC639	30		

TTL DIGITAL

T.T.L. Digital	
7400	26
7402	26
7404	30
7408	28
7410	26
7420	26
7430	26
7447	$1.26
7451	26
7454	26
7474	26
7490	65
7492	65
74107	45

LINEAR

LM301	50
LM307	70
LM308	1.30
LM309K	1.95
LM324	2.24
LM339	1.55
LM377	1.95
LM380	1.30
LM382	1.30
LM3900	1.10
LM555	57
LM566	2.29
LM709	45
LM723	55
LM741	45
LM1458	72

ELECTROLYTICS

Value	Voltage		Value	Voltage	
1 uFd	6.3 Axial	13	100 uFd	25 p.c.b.	15
2.2 uFd	25 p.c.b.	8	220 uFd	6.3 p.c.b.	17
3.3 uFd	25 p.c.b.	8	220 uFd	16 p.c.b.	17
4.7 uFd	10 p.c.b.	8	220 uFd	35 p.c.b.	22
4.7 uFd	25 p.c.b.	8	470 uFd	6.3 p.c.b.	22
22 uFd	10 p.c.b.	8	470 uFd	25 p.c.b.	22
22 uFd	50 p.c.b.	15	1000 uFd	10 Axial	35
25 uFd	16 p.c.b.	8	1000 uFd	16 p.c.b.	36
33 uFd	6.3 p.c.b.	9	1000 uFd	25 p.c.b.	47
33 uFd	16 p.c.b.	10	1000 uFd	35 p.c.b.	47
47 uFd	10 p.c.b.	12	1000 uFd	50 p.c.b.	80
47 uFd	25 p.c.b.	14	2200 uFd	50 upright	$1.60
47 uFd	50 p.c.b.	15	3300uFd	50 upright	$1.75
100 uFd	10 p.c.b.	13	3300 uFd	75 upright	$2.40

555 TIMER APPLICATIONS

DESCRIBED BY R. M. MARSTON PART 4

Miscellaneous Applications

To complete the story of the 555, this final section shows a miscellany of 555 applications, of varying degrees of usefulness. Figure 29 shows how a single 555 can be used as the basis of an event-failure alarm or a missing-pulse detector, which closes a relay or illuminates an LED if a normally recurrent event fails to take place.

The operating theory of the circuit is fairly simple. The 555 is wired as a normal monostable pulse generator, except that transistor Q1 is wired across timing capacitor C1 and has its base taken to TRIGGER pin 2 of the IC via R3: The TRIGGER pin is fed with a train of pulse or switch-derived clock input signals from the monitored event, and the values of R1 and C1 are selected so that the monostable period of the IC is slightly longer than the repetition period of the clock signal.

Thus, each time a clock pulse arrives, a monostable timing period is initiated via pin 2 of the IC, and C1 is discharged and the pin 3 output is driven high via transistor Q1. Before each monostable period can terminate, a new clock pulse arrives, and a new monostable period is initiated, so the pin 3 output terminal remains high so long as clock input pulses continue to arrive within the prescribed period limits. Should a clock pulse be missed, or the clock period exceed the pre-determined limits, however, the monostable period will be able to terminate normally, and pin 3 of the IC will go low and drive the relay or LED on. The circuit thus functions effectively as an event-failure alarm or missing-pulse detector. With the component values shown, the monostable has a natural period of about 30 seconds. This period can be varied via R1 and C4 to satisfy specific requirements.

Figure 30 shows how a couple of 555s can be used to make a pulse-width modulation (PWM) circuit. This circuit can be used for transmitting coded messages, or for applying variable power to a load at maximum efficiency.

Here, IC1 is wired as 1 kHz astable multivibrator, which is used to feed a continuous train of clock pulses to the pin 2 TRIGGER terminal of IC2, which is wired as a normal mono-

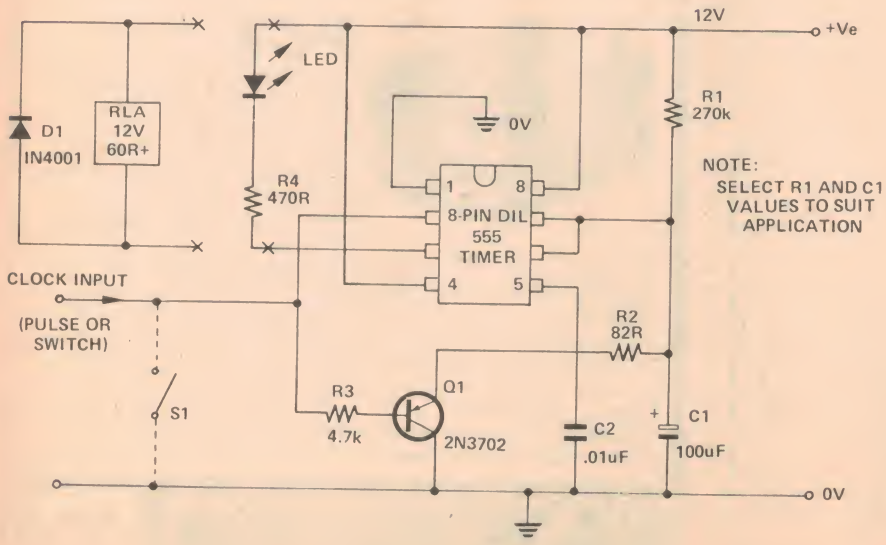


Fig. 29. Event-failure alarm or missing-pulse detector has relay or LED output.

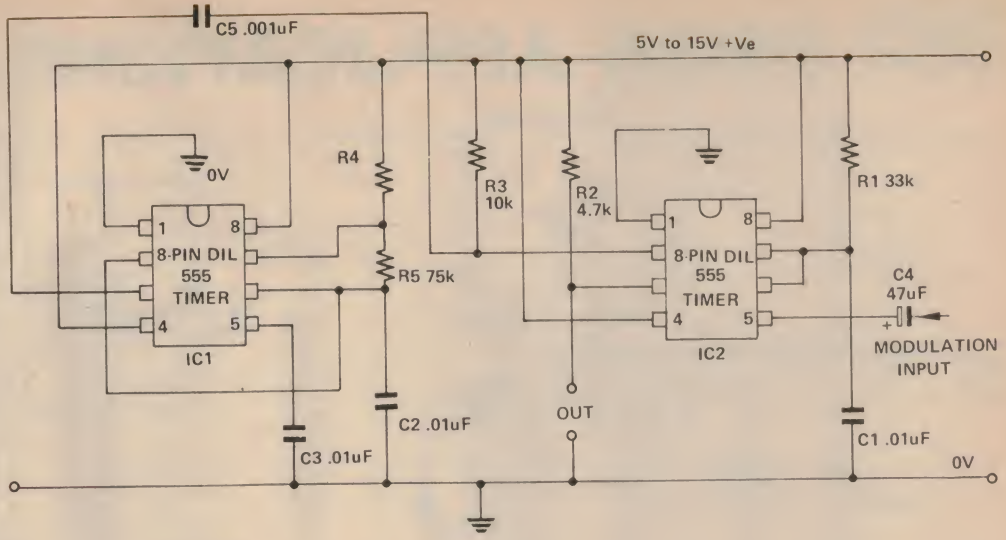


Fig. 30. Pulse-width modulation (PWM) circuit.

stable multivibrator or pulse generator and has a natural monostable period of approximately 0.36 mS. The external modulation signal is fed to the pin 5 CONTROL VOLTAGE terminal of the monostable via C4, and determines the instantaneous widths of the generated pulses. Thus, the circuit generates a train of pulse-width modulated (PWM) pulses at a fixed repitition frequency of 1 kHz.

Scope timebase

Figure 31 shows how a basic 555 monostable multivibrator can be modified so that it generates a linear ramp waveform of fixed duration each time it is triggered: The circuit can form the basis of an excellent oscilloscope time-base generator. The circuit works just like a normal monostable circuit, except that timing capacitor C1 is charged via constant-current generator Q1 during each timing cycle, thus causing a linear ramp voltage to be generated across C1.

When a capacitor is charged via a constant-current generator, the voltage across the capacitor rises linearly at a predictable rate that is determined by the magnitudes of the charging current and the capacitance. The relationship can be expressed as:

Volts-per-second = I/C, when I is expressed in amps and C is expressed in farads.

In this circuit the charging current can be varied over the approximate range 90 μA to 1 mA via R4, thus giving rates of rise on the .01 μF capacitor of 9 V-per-ms to 100 V-per-ms. Now, remembering that each monostable period of the 555 circuit terminates at the point when C1 voltage reaches 2/3 Vcc, and assuming that a 9 V supply is used (giving a 2/3 Vcc value of 6 V), it can be seen that the monostable cycles of the Fig 32 circuit have periods variable from 666 μS to 60 μS. Periods can be increased beyond these values by increasing the C1 value, or vice versa. Note when using this circuit that its supply rail must be stabilised if stable timing periods are to be obtained.

If the circuit of Fig 31 is to be used as the basis of an oscilloscope timebase, note that the input driving signal must first be converted to a good square wave, from which suitable trigger pulses can be derived via C3 and R5. The minimum useful ramp period that can be obtained from the circuit is about 5 μS, which, when expanded to give full deflection on a ten-division 'scope screen, gives a maximum timebase speed of 0.5 μS-per-division. Flyback beam-suppression signals can be

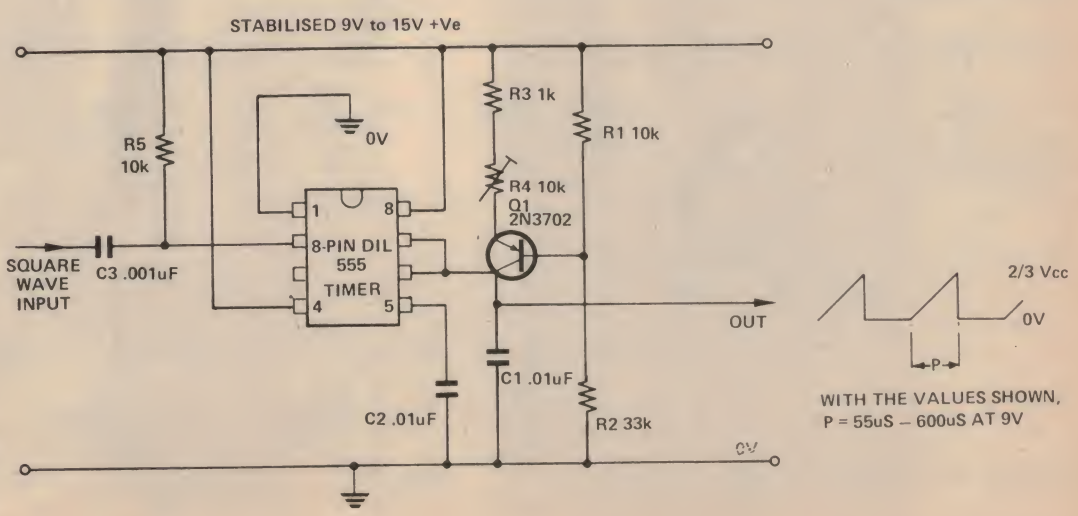


Fig. 31. Triggered linear-ramp generator can be used as the basis of an oscilloscope time-base.

555 TIMER APPLICATIONS

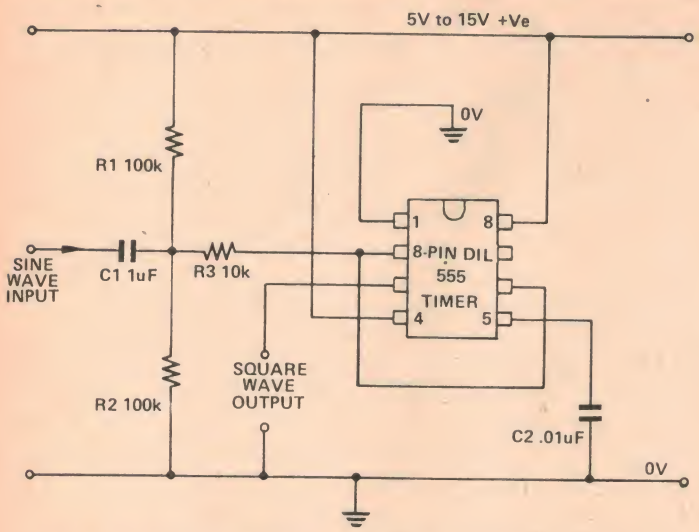


Fig. 32. 555 Schmitt trigger circuit acts as excellent sine/square converter up to about 150 kHz.

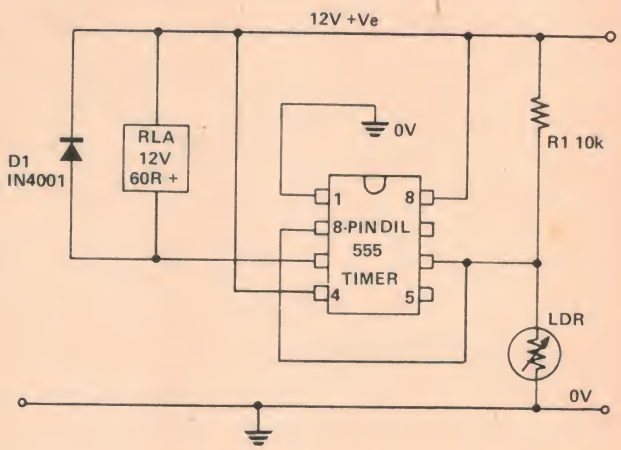


Fig. 33. Dark-activated relay switch has built-in backlash.

derived from the pin 3 OUTPUT terminal of the IC.

The 'timebase' circuit gives superb signal synchronisation at trigger frequencies up to about 150 kHz. If the timebase is to be used with input signal frequencies greater than this, the input signals should be divided down via a single- or multi-decade digital divider. Using this technique, the timebase can be used to view input signals up to many MHz.

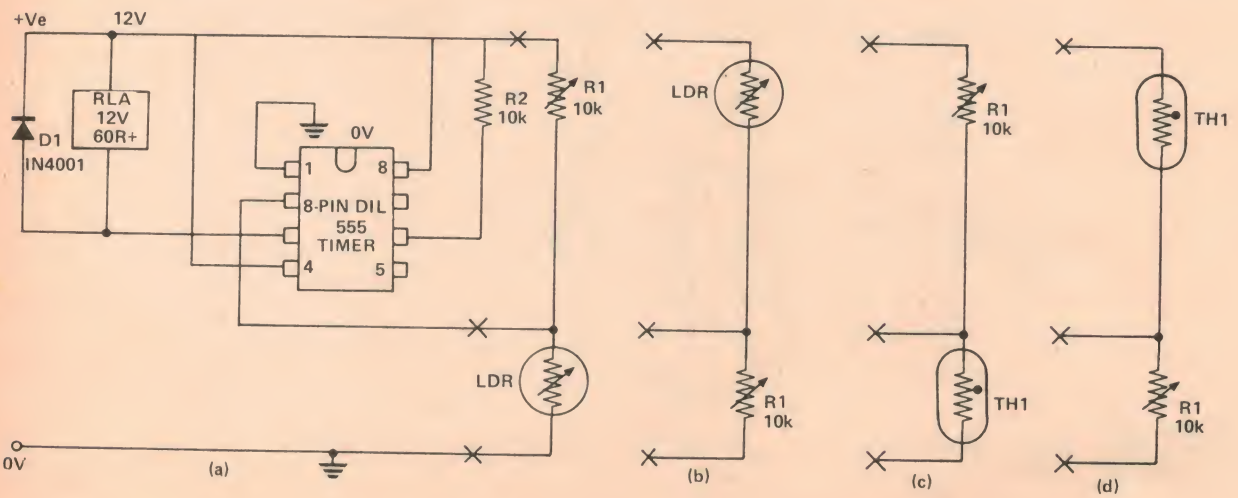
Figure 32 shows how a 555 can be connected for use as a simple but effective Schmitt trigger or Sine/Square converter. The circuit acts as a good converter at input frequencies up to 150 kHz or more. It works by changing its output state each time the pin 2 input signal swings from above the 2/3 Vcc level to below the 1/3 Vcc level, or vice versa. Resistor R3 is wired in series with pin 2 of the chip to ensure that the input signal is not adversely influenced by the transition action of the IC.

Figure 33 shows how the basic Schmitt circuit can be adapted to a dark-activated relay driving application by wiring light-dependent potential divider R1-LDR to the pin 2 input terminal of the IC. This circuit has an inherently high degree of input backlash, and is likely to be of value in only very specialised applications.

A far more useful relay-driving switching circuit is shown in Fig 34. This circuit has negligible input backlash, and can be used as either a light- or temperature-activated switch. In light-activated applications R1 is wired in series with a cadmium-sulphide photocell that presents a resistance in the approximate range 470 Ω to 10 kΩ at the required turn-on level. Dark-activated operation can be obtained by using the connections shown in Fig 34a or light-activated operation can be obtained by using the connections shown in Fig 34b.

For temperature-activated operation, R1 must be wired in series with a negative-temperature-coefficient thermistor, This thermistor must present a resistance in the range 470 Ω to 10 kΩ at the required turn-on level. Under-temperature operation can be obtained by using the connections shown in Fig 34c, or over-temperature operation can be obtained by using the connections shown in Fig 34d.

Fig. 34. Minimum-backlash relay switch can be activated by (a) dark, (b) light, (c) under-temperature, or (d) over-temperature.



1 kHz Analogue Frequency Meter

This circuit needs a square-wave input driving signal with a peak-to-peak amplitude of two volts or greater. In this circuit the 555 is wired as a standard monostable multivibrator or pulse generator, and is powered from a regulated 6 V supply. Transistor Q1 is used to amplify the square wave input signals to a level suitable for triggering the monostable stage, and the output of the monostable is fed to 1 mA fsd meter M1 via multiplier resistor R5 and offset-cancelling diode D1. This meter gives a reading that is directly proportional to the frequency of the square wave input signals, and its operating theory is as follows:

Each time the monostable multivibrator is triggered it generates a pulse of fixed duration and fixed amplitude. If we assume that each generated pulse has a peak amplitude of 10 V and a period of 1 ms, and that the pulse generator is triggered at an input frequency of 500 Hz, it can be seen that the pulse is high (at 10 V) for 500 ms in each 1000 ms total period, and that the MEAN value of output voltage measured over this total period is 250 ms/1000 ms x 10 V = 5 V, or 50% of 10 V. Similarly, if the input frequency is 250 Hz the pulse is high for 250 ms in each 1000 ms total period, so the mean output voltage equals 250 ms/1000 ms x 10 V = 2.5 V, or 25% of 10 V. Thus, the mean value of output voltage of the pulse generator, measured over a reasonable total number of pulses, is directly proportional to the repetition frequency of the generator.

Normal moving coil meters are 'mean' reading instruments, and in the Fig 35 circuit a 1 mA fsd moving coil meter is wired in series with voltage multiplier resistor R5, which sets the meter sensitivity at about 3.4 V fsd, and is connected so that it reads the mean output voltage of the pulse generator. This meter thus gives a reading that is directly proportional to

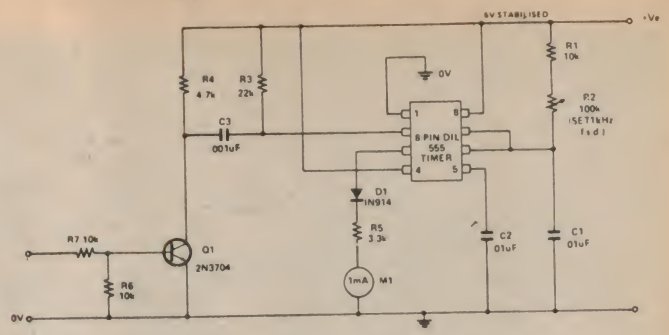


Fig. 35. Simple 1 kHz linear-scale analogue frequency meter.

frequency, and the circuit thus acts as a linear-scale analogue frequency meter. With the component values shown the circuit is intended to read fsd at 1 kHz. To set up the circuit initially, simply feed a 1 kHz square wave signal to its input, and then adjust R2 (which controls the pulse lengths) to give full-scale reading on the meter; all adjustments are then complete.

The full-scale frequency of the above circuit can be varied from about 100 Hz to about 100 kHz by suitable choice of C1 value. The circuit can be used to read frequencies up to tens of MHz by feeding the input signals to the monostable circuit via a single- or multi-decade digital divider, thereby reducing the input frequencies to values that can be read by the monostable circuit. The circuit can form the basis of an excellent and inexpensive multi-range linear-scale analogue frequency meter.

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ETI's COMPUTER SECTION

NEWS

Home Computer Market This Year?

Last month, we mentioned the introduction of Commodore's PET 2001 home computer, which will sell for around $500 in the States. It now seems that Commodore aren't alone in this market – other manufacturers are falling over each other in the rush to get a slice of the action, amongst them Texas Instruments, RCA, Radio Shack (Tandy), and a bunch of TV games manufacturers including Atari, Magnavox and Bally. With this competition, pricing is going to be very tricky – for example Radio Shack's effort incorporates a Z-80, 4 Kbytes of RAM, VDU, keyboard and cassette interface for US$800.

VLSI Progress

Over the next three years, five major Japanese electronics firms will invest over $250 million in a Government-sponsored very large-scale integration project, with the aim of developing 1 Mbit memory chips and MPUs with five times as many gates as current devices.

TI Calcs Use Plug-in ROMs

Texas Instruments are about to rock the pocket programmable calculator market by introducing three new models. The top-of-the-line TI Programmable 59 uses a plug-in plastic 5 Kbyte ROM block to give 5,000 steps of program memory containing a selection of software – various application libraries are available.

The Programmable 59 also features up to 100 memory registers, or 960 steps of program memory, which can be saved and loaded by means of magnetic cards, plus 11 test registers, 72 labels, 6 levels of subroutine nesting, 9 sets of parentheses, indirect addressing and a total of 175 functions and operations. When coupled with the PC100A thermal printer, the P59 can print alphanumerics including symbols, and prints program headings. Now that we've stunned you with all those high numbers, we'll hit you with the Stateside price – $300.

Planned introduction to Australia will be around early September (so don't bother phoning TI yet); and, needless to say, we'll follow this one up with an in-depth report.

National MPU

Elsewhere in this issue we mention the MM5799 COPS processor. Now, although this is a nice device, it is mask-programmed, and so unsuitable for the hobbyist. But the new MM57109 is preprogrammed as a scientific calculator, with test and branch facilities, error flag and RPN operation. It can be used as a stand-alone processor or can be stuck on the bus of your microcomputer to do subsidiary 'number crunching'.

MITS Redeal

MITS, who manufacture the Altair range of hobby and small business computers, are reported to be considering expansion of their marketing effort. At present there are 26 franchised Altair dealers, who retail only MITS equipment. This policy doesn't seem to have been particularly successful, and they may now permit dealers to sell non-MITS hardware, as well as expanding the number of dealers.

Elementary, My Dear Reader

In a recent US trade publication, Texas Instruments are advertising various staff vacancies, in connection with 'Electronic Consumer Products'. One is for a 'Programmable Product Marketing Engineer' to 'Build and develop retail distribution network. Be responsible for customer training... Requires good understanding of consumer marketing...'. Could mean calculators, I suppose. But in the same ad: 'Scientific Programmer. Develop algorithms, microcode, assemblers, and simulators supporting LSI microprocessor designs for consumer products.' Now, calculators don't require assemblers; could they be looking at a consumer (i.e. home) computer?

Intel Math Board

The 3000 series bipolar bit-slice MPU has been used by Intel in a 'math board' which can be used as a slave to any SBC 80 single-board computer. The US$600 board provides fixed-point integer and floating-point arithmetic capability an order of magnitude better than the 8080 alone. For example, an SBC 80/20 with the SBC 310 'math board' can perform a fixed-point multiply in 70 microseconds, which is comparable to the performance of an LSI-11.

New VDU

In the States, Southwest Technical Products has introduced the CT-64 terminal kit, priced at $325. The device has two 1 K memory pages, 16 lines of 64 characters using a 128-character set, and features scrolling, complete cursor control, video inversion and a number of display options. A matching, fully assembled 9 inch monitor for $175 completes the terminal.

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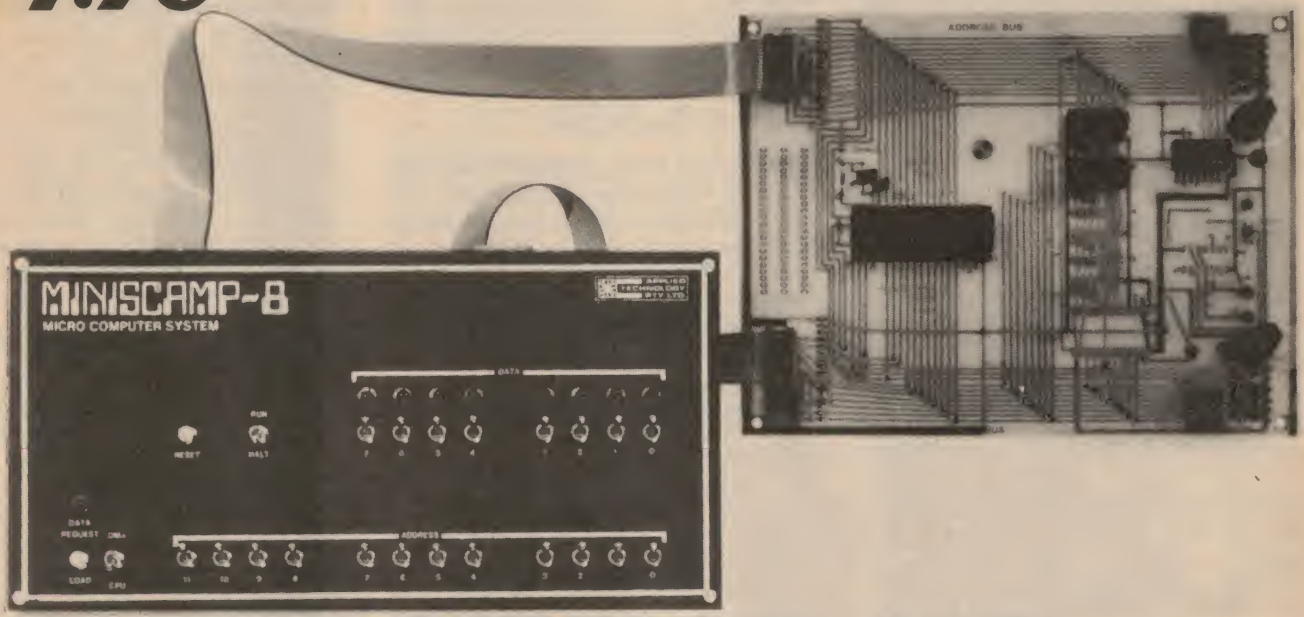

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PERSONAL COMPUTING
The Early Years...

by Peter Vogel.

In The Beginning

It all started back in 1974 when Intel introduced the 4004, the first true microprocessor. It developed almost by accident, as a result of Intel's efforts to produce a calculator of unprecedented flexibility. The shock waves of the hand-held calculator revolution were still being felt by every section of society and the back-room boys' eyes lit up with that "You ain't seen nothing yet" look as they drew up the chip-masks for their next product, the 8-bit 8008.

Assisted by the lessons learned from the cut-throat calculator business the microprocessor developed with frightening speed and predictability. Frightening not only because of the vast amount of high-technology and high finance poured into the field, but also because of the dramatic effect extrapolations of such technology can have on a broad spectrum of society. Predictable because everyone knew what was going to develop. The shrinking of calculators from giant cabinets to flip-top packs in the space of just a few years created an extraordinary blase attitude towards electronics. It was a spectacular demonstration of the omnipotence of the new technology of micro-electronics. It was proof that now nothing is impossible – just draw up the specifications, expend x thousand man-hours and y million dollars, and there you have it. So the microprocessor has been born at a time when nothing comes as a surprise any more. But maybe the real surprise is yet to come.

The New "Hams"

Of all the sub-sets of electronics hobbyists the most clearly defined to date has been the radio amateur. Members of this particular sect follow a technological faith which started with the first wireless communication and has since flourished, gaining millions of followers in a relatively short time.

For many hams their hobby almost becomes a life-style within itself, always striving for that rare DX the eternal pursuit of that elusive one-to-one SWR. Is it possible that we are now witnessing the founding of a new faith, one whose god speaks in 1s and 0s rather than 5s and 9s?

By making a few comparisons between amateur radio and amateur computing certain patterns can be seen emerging which may be an indication of what course the future of personal computing might take.

Power To The People

Like amateur radio, amateur computing is a high-technology which makes the latest developments in the science of electronics available to anyone at all who has the time and money to pursue them. The money factor is all important – the lower the cost of the hardware, the more people can afford to pursue the hobby. A reasonably useful micro-computer system might cost in the order of $1000. Hams might spend this sort of money on radio gear, for that matter a radio-controlled aircraft enthusiast, amateur photographer or stamp-collector could easily spend that much on his hobby. So thanks to the microprocessor the cost of your own personal computer is no longer a barrier to most people.

This new accessibility and the free interchange of ideas and information between hobbyists has the effect of distributing "computer power" over a broad spectrum of people. This leads to a breaking down of much of the mystique which has traditionally surrounded the world of computers; they are being de-mystified as the magic is systematically exposed as little more than sleight of hand. As large numbers of amateurs invade a hitherto sacred field which was once the sole province of a privileged few the elite will inevitably grow in number until it finally becomes plebian.

"Homebrew" vs "Appliance"

As with amateur radio there are two factions within the computer cult, the "homebrewer" who builds his own equipment for the sake of the experience gained, and the "appliance operator" who buys a ready-built, going unit and gets what he wants from operating his instrument, writing programs and experimenting with the performance of the hardware as bought. His investment in the computer itself is

more financial and less emotional than in the case of the homebrewer.

There is always some overlap between the two factions, but they can usually be classified by comparing the time spent building, testing and modifying the hardware to the time spent actually using it once it's working.

The Sky's The Limit

Radio equipment has rather unique and interesting characteristics. It can never really be declared "finished". There is always more to add to the station, improvements to be made, better antennas, higher power, lower noise. Computers share this trait which makes them too the ideal subject for a hobby. Today's mass storage is tomorrow's scratch-pad. There is unlimited scope for improvement and expansion of the hardware.

If ever the computer itself should look like having its full complement of RAM, ROM and I/O parts, the hobbyist can turn his attention to the vast range of peripherals that are available to him. A radio transmitter can be hooked up to an antenna and a microphone and that's about it, but nothing can be so insular as to resist interfacing to a computer if the intrepid hobbyist uses a little imagination.

More importantly, once the computer is operative a literally infinite amount of software development waits to be done. Like radio operating, this phase of the hobby is particularly attractive because the operating cost is nothing more than the electricity bill.

The Junk Box

Ever since the tradition of stripping a discarded radio chassis was established by the pioneers of amateur radio, the humble junk box has been the hallmark of the truly worthy hobbyist. In much the same way as one may judge someone's social standing by the way he dresses, how neatly his garden is kept, radio amateurs assess each other's status by the quality and quantity of the bits and pieces which lurk for years in the dark recesses of their junk box until their their true worth is finally recognised and they are discarded. Because the microcomputer hobby is so new, junk box computer parts of good vintage are rarer, but there is always the stimulating challenge of pushing a seemingly irredeemable piece of obsolete equipment into service. Radio ham and computer hobbyist alike share the unique pride and joy of operating equipment which the professionals have officially declared worthless.

Doing The Impossible

Besides the resurrection of dead equipment, hams are keen on performing another type of miracle. This involves proving by practical demonstration that something which should by rights not be possible does, in fact, work. With amateur radio this usually entails forging forth into extremes of technology (or bad practice, depending on how you look at it), generally revolving around a successful communication in spite of a red-hot "final", vast distances or an antenna made of wet string.

To the computer ham comparable feats entail successful execution of programs which are either exceptionally short or unbelievably long or so cunningly convoluted that not even the person who wrote it knows how it works. Thanks to the new technology involved there is also a whole new set of miracles which rely on getting a phenomenal number of logic functions into an incredibly small space.

Amateurs are in a rather unique position in that they are permitted to exceed manufacturers ratings to see to what limits they can push a particular component or piece of equipment. This practice gave rise to many novel techniques in the field of radio and a similar thing is bound to happen in computing.

Time Is Not Money

Amateurs make many other contributions to the science to which they are devoted as a result of the enormous amount of time they spend on their hobby. Because of the non-commercial nature of their pursuits, computer hobbyists can afford to undertake time-consuming projects which would not be economical as a professional enterprise.

Like the radio amateur who stays awake all night tuning across the bands looking for a rare contact, the computer ham often burns the midnight oil chasing an elusive bug in his software. Radio propagation never seems to be optimum at a civilized hour; similarly the software bugs only seem to come out just before sunrise.

With both amateur radio and amateur computing the real fun of the hobby lies in setting a goal and then achieving it no matter how long it takes or how inefficient the techniques used may be. The computer ham may devote hundreds of hours to developing a program that does nothing more than play a seemingly useless game. But, as with any technical hobby, a lot of valuable techniques are learned in the process.

Spreading The Word

A natural development from any widely followed hobby is the formation of clubs where people with similar interests can meet and exchange ideas. Major amateur radio clubs like the Radio Society of Great Britain, the Amateur Radio Relay League and the Wireless Institute of Australia have been established for many years and cater for

The software bugs seem to come out just before sunrise.

PERSONAL COMPUTING
The Early Years...

hundreds of thousands of enthusiasts.

Even though the do-it-yourself computer hobby is so young there are already hundreds of computer hobby clubs. The biggest of these are found on the west coast of America which is where most of the world's microprocessor products originate. The Southern California Computing Society has about 5000 members. At the moment there are nearly 200 smaller computer clubs in the USA and an estimated 20,000 people have their own personal computer.

Magazines devoted entirely to the computer hobbyist have been established with great success. The most widely read glossy is **byte** which now circulates over 60,000 copies.

The radio amateurs' "field day" has always provided a means of information exchange between individuals. As communication is the basis of ham radio, publicising such events poses no problems, but computer hams have only their specialist magazines for such promotion. A few conventions have been held by computer hobbyists where the main purpose has been to establish standards so that hobbyists can easily share the software they have developed. Manufacturers of personal computing hardware also take an interest in these gatherings because it is an excellent opportunity to find out what the hobbyist is interested in and therefore which products will sell.

Speaking of Computers

Due to the unusually verbal nature of the hobby itself, radio amateurs have developed a unique vocabulary. The language which results has such a high jargon content and is spoken so fluently that it is quite unintelligible to the outsider. This serves to give the group its own identity and bind its members together.

Although amateur computing is still in its infancy its followers found that the computer industry had already provided them with a highly developed jargon, complete with an impressive range of off-the-shelf buzzwords which have been nutured to perfection by 20 years of professional verbal dazzling. This they have eagerly seized and followers now have a language of their own.

The most telling sign of both radio and computer hams is their often amusing ability to construct seemingly meaningful sentences using all the rules of English grammar except that the keywords are replaced with strings of numbers or initials. The radio amateur might say, "QRX, I've got to check my SWR", while the computer amateur could hit you with, "I've put a PIA on my 6800 for I/O."

To the uninitiated talking in code like this seems like an awfully anti-social way of passing secret messages between club members – it serves to keep the in-group "in" by providing a feeling of comradeship for members and it keeps out all but the most determined newcomers.

Future Shock (Electric)

Although personal computing is already well established as a hobby, the real impact of its advent is yet to come.

It is a characteristic of any hobby that those who pursue it develop great expertise in the field. A keen 10 year old stamp collector may know as much about stamps as a professional stamp dealer. Having spent his youth building radio transmitters a ham of 20 might know as much about radio as a University-qualified electronic engineer.

We are now finding a new breed of hobbyist/expert, a hobbyist who has spent thousands of hours of leisure time building computers and programming them. He could well know more about computers than many professionals in the field. As the hobby grows there will be more and more people to whom computers are second nature, people who are fully conversant with a broad range of computer concepts and totally up-to-date with the state of the art.

Traditional training and qualifications are already being seriously challenged by these hobbyists who might enroll in a University computer science course already knowing more than they will be taught.

As this flood of expertise hits the workforce we are bound to see dramatic changes in the status of the computer professional. Will there be a sudden surplus of computer engineers and programmers, or will the wave of new technology bring with it expansion of the industry to absorb it?

The remarkable advances in solid state technology which led to the development of microprocessors have made their mark on the electronics industry, but it's the "expertise explosion" which will follow that will have the real impact on society.

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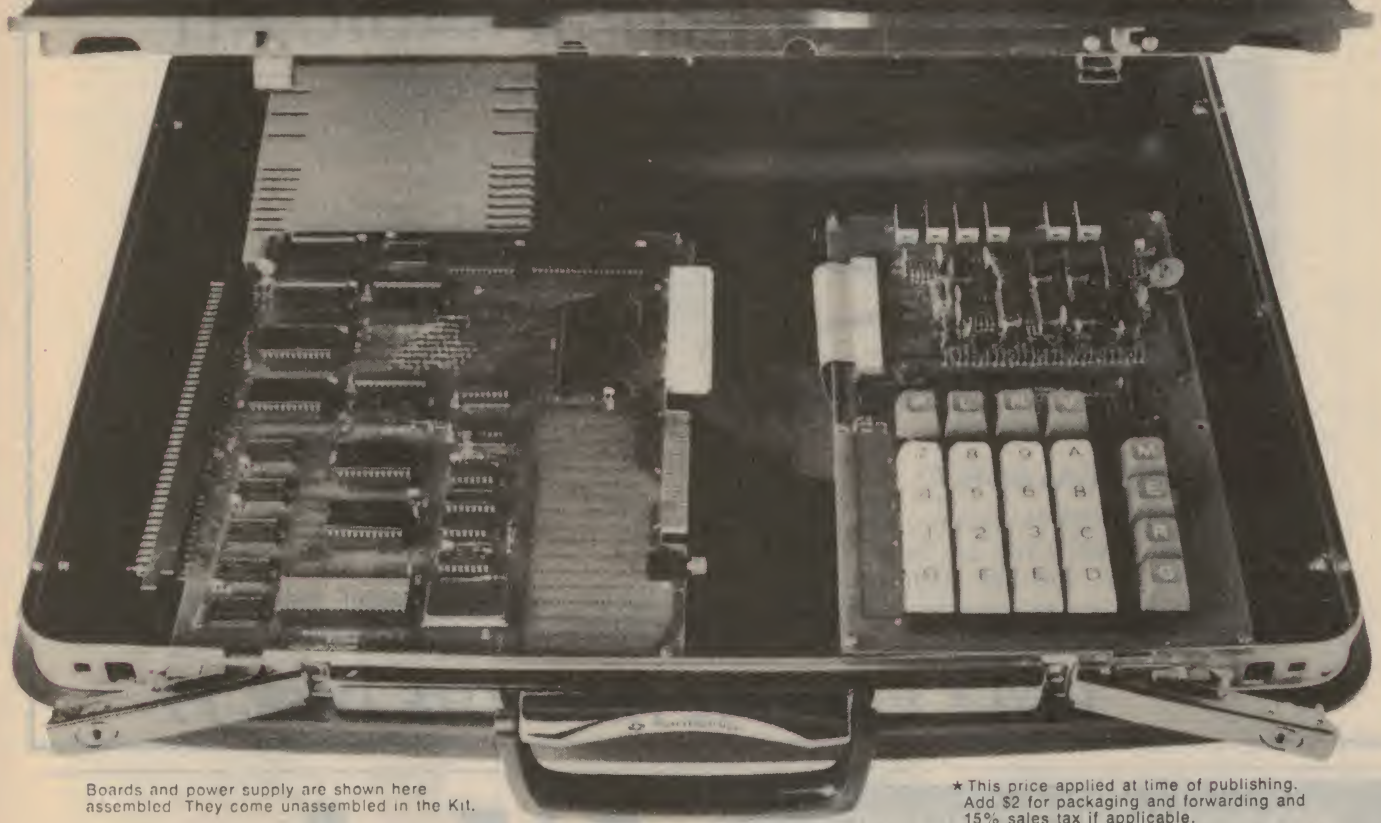

Boards and power supply are shown here assembled. They come unassembled in the Kit.

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- J-Bug Monitor

Keyboard Features:

- Punch Designated Memory to Audio Cassette
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- Trace 1 Instruction
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- Examine and Change Memory
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- Proceed from Breakpoint
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Expandability Features:

The MPU Module Card is prewired for ease of expandability and is capable of accepting the following devices:

2	MCM6810	128 X 8 RAM's
3	MC8T96	Address Buffers
2	MC8T26	Bidirectional Buffers

AND, any two of the following by using strapping options:

MCM68316E	2K X 8 ROM
MCM68708	1K X 8 AROM
MCM68308	1K X 8 ROM
HA7640	512 X 8 PROM

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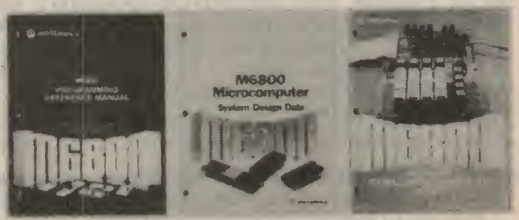

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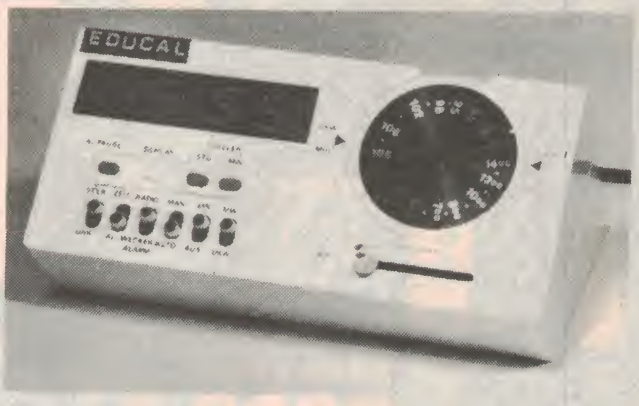

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Any companies who want to be included in this list should phone LES BELL on 33-4282.

Key to companies:

- A Applied Technology Pty. Ltd. of Hornsby, NSW.
- C Amateur Communications Advancements, PO Box 57, Rozelle, NSW.
- D Dick Smith Pty. Ltd. of Crows Nest, NSW.
- E E.D. & E. Sales, Victoria.
- J Jaycar Pty. Ltd. of Haymarket, NSW.
- L Delsound Pty. Queensland.
- N Nebula Electronics Pty. Ltd. of Rushcutters Bay, NSW.
- O Appollo Video Games of Hornsby, NSW.
- P Pre-Pak Electronics of Croydon, NSW.

PROJECT ELECTRONICS

ETI 043	Heads or Tails	A
ETI 044	Two-Tone Doorbell	A
ETI 061	Simple Amplifier	A
ETI 064	Intercom	A
ETI 066	Temperature Alarm	A
ETI 068	LED Dice	A

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ETI 101	Logic Power Supply	E
ETI 102	Audio Signal Generator	E,D
ETI 103	Logic Probe	E
ETI 107	Widerange Voltmeter	E
ETI 108	Decade Resistance Box	E
ETI 109	Digital Frequency Meter	E
ETI 111	IC Power Supply	E
ETI 112	Audio Attenuator	E
ETI 113	7-Input Thermocouple Meter	P,E
ETI 116	Impedance Meter	E
ETI 117	Digital Voltmeter	E,A
ETI 118	Simple Frequency Counter	E,A
ETI 119	5 V Switching Regulator supply	E
ETI 120	Logic Probe	L,E
ETI 121	Logic Pulser	L,E
ETI 122	Logic Tester	E
ETI 123	CMOS Tester	E
ETI 124	Tone Burst Generator	E
ETI 128	Audio Millivoltmeter	L,E
ETI 129	RF Signal Generator	L,E
ETI 131	General Purpose power supply	E,N
ETI 132	Power Supply	N

SIMPLE PROJECTS

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ETI 218	Monophonic Organ	E,D
ETI 219	Siren	E
ETI 220	Siren	E
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ETI 232	Courtesy Light Extender	E
ETI 234	Simple Intercom	E
ETI 236	Code Practice Oscillator	E
ETI 239	Breakdown Beacon	E

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ETI 302	Tacho Dwell	E
ETI 303	Brake-light Warning	E
ETI 309	Battery Charger	P,E
ETI 312	CDI Electronic Ignition	P,E
ETI 313	Car Alarm	E,D

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ETI 403	Guitar Sound Unit	E
ETI 406	One Transistor Receiver	E
ETI 407	Bass A.p	E
ETI 408	Spring Reverb. Unit	E
ETI 410	Super Stereo	E
ETI 413	100 Watt Guitar Amp	P,L,E,J,D
ETI 413	x 200 Watt Bridge Amp	E
ETI 414	Master Mixer	E,J
ETI 414	Stage Mixer	E
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P,E,D
ETI 420	Four-channel Amplifier	L,E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	L,E,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-on Decoder Amp	E
ETI 424	Spring Reverberation Unit	L,E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETi 427	Graphic Equaliser	L,E,J
ETI 430	Microphone Line Amp	E
ETI 433	Active Crossover	E,J
ETI 435	Crossover Amp	E,J
ETI 438	Audio Level Meter	L,E
ETI 440	Simple 25 Watt Amp	L,E
ETI 441	Audio Noise Generator	L,E
ETI 443	Compressor-Expander	E,J
ETI 444	Five Watt Stereo	E
ETI 445	Preamp	J,E,D
ETI 446	Audio Limiter	J,E
ETI 447	Phaser	E,J
ETi 449	Balanced Mic Preamp	J
ETI 480	50 W, 100 W Power Amp	A
ETI 480P	Power Supply	A
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ETI 526	Printimer	E
ETI 527	Touch Control Light Dimmer	E
ETI 528	Home Burglar Alarm	P,E
ETI 529	Electronic Poker Machine	E
ETI 533	Digital Display	L,E,A
ETI 534	Calculator Stopwatch	A,D
ETI 539	Touch Switch	E
ETI 540	Universal Timer	E
ETI 541	Train Controller	E
ETI 543	Double Dice	A
ETI 544	Heartrate Monitor	A

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ETI 702	Radar Intruder Alarm	D
ETI 703	Antenna Matching Unit	E
ETI 704	Crosshatch/Dot Generator	L,A,D,E
ETI 706	Marker Generator	E
ETI 707	Modern Solid State Converters	C,E
ETI 708	Active Antenna	E
ETI 710	2 metre Booster	C,E
ETI 711B	Single Relay Remote Control	A
ETI 711C	Double Relay Remote Control	A
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22	16V	P.T.	.20
22	25V	PCB	.20
22	63V	P.T.	.25
33	10V	PCB	.20
33	25V	PCB	.20
33	35V	PCB	.25
33	50V	PCB	.25
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47	25V	PCB	.25
47	35V	PCB	.25
47	35V	P.T.	.25
47	350V	P.T.	$1.30
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100	63	P.T.	.35
100	63	P.T.	.35
100	63	P.T.	.35
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220	25	PCB	.45
220	35	P.T.	.45
220	50	PCB	.65
220	63	P.T.	.65
330	10	PCB	.35
330	16	P.T.	.35
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1000	25	PCB	.85
1000	35	P.T.	$1.00
1000	63	P.T.	$1.30
2200	16	P.T.	.95
2200	25	P.T.	$1.40
3300	16	P.T.	$1.30

INTEGRATED CIRCUITS TTL

7400	.45c	7447	
7401	.45c	7450	$1.95
7402	.45c	7453	.50
7403	.45c	7460	.50
7404	.45c	7473	.50
7406	.45c	7476	$1.00
7407	$1.20	7483	$1.10
7408	$1.20	7490	$1.80
7409	.50	7491	$1.00
7410	.50	7493	$1.40
7411	.50	74100	$1.10
7412	.50	74107	$1.00
7413	.80	74141	$1.00
7416	$1.30	74145	$3.20
7420	$1.00	74151	$1.00
7427	.50	74154	$1.00
7430	$1.00	74164	$3.45
7432	.45	74181	$3.50
7440	.80c	74182	$1.00
7441	.50c		$1.00
7442	$1.50		
	$1.30	Also CMOS, linear, etc.	

RESISTORS AND POTS

Resistors — Preferred values viz: 1, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, and multiples, 1 ohm to 10 mg in 1/4W, 1/2W, 1W — 3c ea or $2.50 per 100. Most values 5W — 20W price 5W — 45c 10W — 75c

Pots — Preferred values, range 100-2M viz: 1, 2.2 (2.5), 4.7 (5) and multiples in preset (20c ea), tab mtg (45c ea), standard VCU (60c ea), switched VCS (1.10) and 10K-2M ganged VCU ($1.75 ea).

SSB 2 - 15 MHZ AWA 100W TELERADIO TRANSCEIVER

ONLY SIX LEFT!

Last 6 100W SSB transceivers, crystal locked (add your own VFO) 6 channels, select AM. Upper or lower sidebands, only 3 valves, the rest is solid state. New ex factory-bargain priced ⅓ Power supply (12VDC or 240VAC) extra.

$245 ea

"HARD-TO-GET" AND MISCELLANEOUS ITEMS

PCB etch resist pens	$1 50	75-300 ohm balun	$2.00
NIXIE tubes, 0-9, GR111	$1.00 ea	300-75 ohm balun	$2.00
NE-2 neons 60V oper	10c	4XUM-3 batt holder	.30c
TO-3 mtg ins. bushes	50 for 50c	3/8" ferrite rods	.25c
1.5uF 35V tantaliums	15c	Car aerials	$2.50
PVC-2 tuning gangs	50c	ON-OFF toggle switch	40c
3.5mm earphone plugs	10c	DPDT toggle switch	55c
3.5mm sockets	10c	DPDT rotary switch	65c
Fuseholders, in-line 3AG	15c	DPDT slide switch	.30c
5K Trans vol. controls	35c	3PDT rocker switch	.60c
Knobs to suit, 33mm diam	10c	HT suppressors 15K	.35c
Mag. earpieces, 3.5mm plug	30c	MA1002B NS clock	$12.00
Cigar lighter plugs	30c	Transformer to suit	$6.00
240 neon bezels	50c	5 pin din plug	.30c
Car aerial sockets	.5c	9 lug tagstrips	10 for 30c
Alligator clips	10c	16 way plug/socket	$1.00
TK-64 white knobs	15c	50 ohm 2W WW pots	.50c
TK-55 brown knobs	15c	Permeability tuners	$1.00
TK-29 black knobs	15c	Mono cartridges	$1.00
TK-816 alum. knobs	30c	Stereo cartridges C-1	$3.00
70 x 45mm oval spkr 8 ohm	$1.55	6" x 4" speakers	$2.00
58mm diam. spkr 25 ohm	$1.20	UM-3 Ni-cad batts	$1.65
8 track cartridges	$1.20	**Originals or equivalents supplied.**	

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5' Helical Whip, roof or boot mount	$22.00
Base-loaded whip	$19.00
As above, magnet mtg	$19.95
CB/AM/FM combo centre-loaded whip	$30.00
Twin Truckers dual mirror mtg. aerials	$37.70
SWR meter, in-line	$19.50
PL-259 plugs	$1 ea.
RG58/V Cable, per mtr	45c

Large range of CB accessories ex stock.

SPEAKERS, ETC.

Coral		**Hi-Fi Woofers**	
Complete kits with Xovers, etc.		12" 30W 8 ohm	$29.90
85A1 15W RMS	$39.50	10" 25W 8 ohm	$21 75
10SA1 25W RMS	$68.60	8" 15W 8 ohm	$10 50
12SA1 30W RMS	$95.50	8" Twin cone	$11 90
Cabinets available to suit		**Mid-Range**	
Car Speakers — dual imp.		5" 30W 8 ohm	$5 45
5" diam. 4 8 ohm	$5.50	51/4" 20W 8 ohm	$3 50
7" x 5" 4.8 ohm	$5.95	**Tweeters**	
8" x 4" 4.8 ohm	$6.95	Dome 20W 8 ohm	$8.95
9" x 6" 4.8 ohm	$7.50	Dome 50W 8 ohm	$11 00
Crossovers		Cone 21/2" 8 ohm	$1.95
2 WAY 30W	$3.50	Cone 3" 8 ohm	$4.80
3 WAY 40W	$6.95	Horn	$9.95

PLUGS & SOCKETS

Type	Plug	Skt.
2P din	35c	30c
3P din	45c	35c
5P din	48c	40c
2.5mm jack	20c	20c
3.5mm jack	25c	25c
6.5mm jack	45c	35c
6.5 stereo	65c	45c
RCA	25c	25c
2.1mm DC	40c	25c
2.5mm DC	40c	25c
2P AC power	55c	35c
4mm banana	30c	30c

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3 Terminal Voltage Regulators

The A78CB is a monolithic 3-Terminal Positive Regulator with a 13.8 V nominal output voltage. With adequate heat sinking, it can deliver output current in excess of 2.0 A. Just like its predecessors, the industry standard A7800 series of regulators, the A78CB employs current limiting, thermal shutdown and safe area protection and is essentially indestructible. The device is intended as a fixed voltage regulator for home base CB stations, and power supplies for driving automotive accessories directly from the AC line through a transformer, a fullwave rectifier and a filter capacitor. In addition to use as a fixed voltage regulator, the A78CB can be used with external components to obtain adjustable output voltages and/or increased output currents.

- **OUTPUT VOLTAGE OF 13.8 V**
- **OUTPUT CURRENT IN EXCESS OF 2 A**
- **20 W POWER DISSIPATION**
- **NO EXTERNAL COMPONENTS**
- **INTERNAL THERMAL OVERLOAD PROTECTION**
- **INTERNAL SHORT CIRCUIT CURRENT LIMITING**
- **OUTPUT TRANSISTOR SAFE AREA COMPENSATION**
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VIC.:	Browntronics, 419-3992
	Amtron Tyree, 288-7099
	Warburton Franki, 699-4999
W.A.:	Warburton Franki, 65-7000
S.A.:	Gerard & Goodman, 223-2222
	Warburton Franki, 356-7333
QLD.:	Warburton Franki, 52-7255

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Ideas for experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for — generally at a rate of $5 to $7 per item.

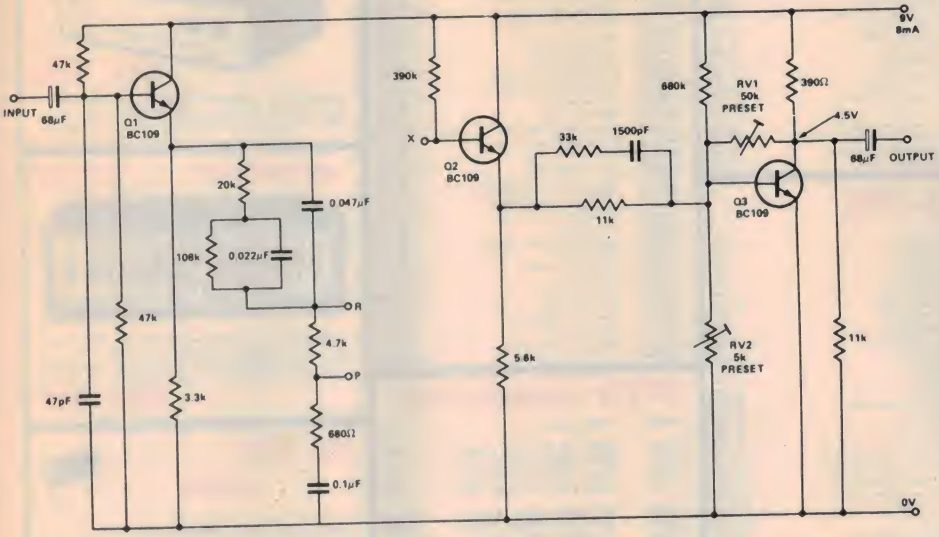
TAPE HISS REDUCTION CIRCUIT

The circuit below is used to either boost or cut frequencies. When making a recording, point X is wired to point R so that treble signals are boosted by 10 dB, and then during playback, point X is wired to point P so that the signal from the tape, including the hiss, has the treble cut by an equivalent amount. The circuit values are such that the overall frequency response, from record through playback, is flat over the range 20 Hz – 20 kHz. Thus the output signal after playback is identical with the input signal before recording, but the hiss is cut by 10 dB.

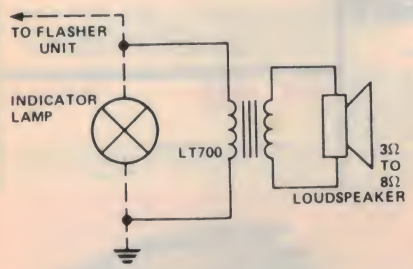
RV1 sets the gain of the circuit to be unity at low frequencies (<500 Hz); RV2 is adjusted so that the collector voltage of Q3 is half the positive rail voltage. When this is set, the circuit will function without apparent distortion with an input voltage of up to 1.5 V rms.

If monitoring during record is not required, the same circuit may be used for record and playback, with X switched between P and R as necessary. If monitoring during record is required, two circuits are needed, one with X wired to R and the other with X wired to P.

For stereo, two circuits are required.



AUDIO TRAFFICATOR INDICATOR



On some cars, the click of the flasher unit cannot be heard above the engine noise etc. This can lead to the trafficator being left on, possibly leading to an accident. The device shown above is simply connected across the existing indicator light, and, when in operation, gives out a loud pulse every time the lamp is turned on and another when the lamps turn off.

Most transistor output transformers could be used, although an LT700 was used in the prototype. The loudspeaker should be a small 3 or 8 ohm unit.

TTL-standard

7400	Quad 2-input nand	32c
7401	Quad 2-input nand (Open collector)	32c
7402	Quad 2-input nor	32c
7403	Quad 2-input nor (Open collector)	32c
7404	Hex inverter	32c
7405	Hex inverter (Open collector)	32c
7406	Hex inverter driver 30V	36c
7407	Hex driver 30V	48c
7408	Quad 2-input and	32c
7409	Quad 2-input and (Open collector)	32c
7410	Triple 3-input nand	32c
7411	Triple 3-input and	48c
7412	Triple 3-input nand (Open collector)	32c
7413	Dual 4-input nand schmitt	56c
7414	Hex inverter schmitt	$1.44
7416	Hex inverter driver 15V	64c
7417	Hex driver 15V	64c
7420	Dual 4-input nand	32c
7421	Dual 4-input and	56c
7422	Dual 4-input nand (Open collector)	56c
7423	Dual 4-input nor expand and strobe	64c
7425	Dual 4-input nor with strobe	44c
7426	Quad 2-input nand driver 15V	44c
7427	Triple 3-input nor	44c
7428	Quad 2-input nor buffer	72c
7430	Single 8-input nand	32c
7432	Quad 2-input or	44c
7433	Quad 2-input nor (Open collector)	80c
7437	Quad 2-input nand buffer	48c
7438	Quad 2-input nand buffer (Open)	48c
7439	Quad 2-input nand buffer (Open)	48c
7440	Dual 4-input nand buffer	32c
7441	BCD to Decimal nixie driver	$1.10
7442	BCD to Decimal decoder	88c
7443	Excess3 to Decimal decoder	$1.56
7444	Excess3 gray to Decimal decoder	$1.56
7445	BCD to Decimal driver 30V	$1.32
7446	BCD to 7 segment driver 30V	$1.24
7447	BCD to 7 segment driver 15V	$1.24
7448	BCD to 7 segment driver	$1.24
7450	Dual 2x2 and or invert expand	32c
7451	Dual 2x2 and or invert	32c
7453	Single 2x1x2x2 and or invert expand	32c
7454	Single 1x1x2x2 and or invert	32c
7460	Dual 4-input expander	32c
7464	Single 4x2x1x2 and or invert	32c
7465	Single 4x2x1x2 and or invert (Open)	76c
7470	Edge trigger JK flip flop	48c
7472	JK Master slave flip flop	48c
7473	Dual JK Master slave flip flop	68c
7474	Dual D flip flop	60c
7475	Quad latch	88c
7476	Dual JK Master slave flip flop	60c
7478	Dual JK Master slave flip flop	$1.48
7479	Dual D flip flop	96c
7480	Gated full adder	88c
7481	16 bit memory	$1.00
7482	2 bit full adder	$1.48
7483	4 bit full adder	$1.32
7484	16 bit memory	$3.96
7485	4 bit magnitude comparator	$1.64
7486	Quad exclusive or	60c
7489	64 bit memory	$3.64
7490	Decade counter	68c
7491	8 bit shift register	$1.12
7492	Divide by 12 counter	60c
7493	Binary counter	60c
7494	4 bit shift register	$1.48
7495	4 bit left right shift register	$1.04
7496	5 bit parallel shift register	$1.32
74100	Dual 4 bit latch	$1.84
74104	Gated JK Master slave flip flop	$1.08
74105	Gated JK JK master slave flip flop	96c
74106	Dual JK edge trigger flip flop	$1.24
74107	Dual JK Master slave flip flop	56c
74109	Dual JK edge trigger flip flop	84c
74110	Gated JK Master slave flip flop	$1.36
74111	Dual JK Master slave flip flop	$1.84
74112	Dual JK edge trigger flip flop	$1.24
74113	Dual JK edge trigger flip flop	$1.24
74114	Dual JK edge trigger flip flop	$1.24
74120	Dual pulse synchronizers	$3.50
74121	Monostable multivibrator	56c
74122	Retriggerable multivibrator	68c
74123	Dual retriggerable multivibrator	76c
74125	Quad tristate buffer invert control	$1.24
74126	Quad tristate buffer direct control	$1.24
74128	50 ohm line driver	$1.64
74132	Quad 2-input nand schmitt	$1.76
74136	Quad exclusive or (Open collector)	$1.64
74141	BCD to Decimal nixie driver	$1.64
74145	BCD to Decimal driver 15V	$1.32
74147	10 line to 4 line priority encoder	$3.96
74148	8 line to 3 line priority encoder	$2.48
74150	16 line to 1 line multiplexer	$1.84
74151	8 channel digital multiplexer	$1.36
74153	Dual 4 line to 1 line multiplexer	$1.24
74154	4 line to 16 line demultiplexer	$1.56
74155	Dual 2 line to 4 line demultiplexer	$1.36
74156	Dual 2 line to 4 line demultiplexer	$1.72
74157	Quad 2 line to 1 line multiplexer	$1.36
74158	Quad 2 line to 1 line multiplexer	$1.60
74160	Decade counter with clear	$1.64
74161	Binary counter with clear	$1.64
74162	Decade counter with clear	$2.20
74163	Binary counter with clear	$2.20
74164	8 bit shift register parallel out	$1.48
74165	8 bit shift register parallel load	$1.84
74166	8 bit shift register	$2.64
74170	16 bit memory	$3.96
74173	Tristate quad D flip flop	$2.64
74174	Hex D flip flop with clear	$1.84
74175	Quad D flip flop with clear	$1.68
74176	Presettable decade counter	$1.52
74177	Presettable binary counter	$1.52
74178	4 bit shift register	$3.12
74179	4 bit shift register	$3.96
74181	Arithmatic logic unit	$3.84
74182	Look ahead carry generator	$1.68
74184	BCD to Binary converter	$3.24
74185	Binary to BCD converter	$3.24
74190	Up Down decade counter	$2.16
74191	Up Down binary counter	$1.52
74192	Up Down decade counter	$1.52
74193	Up Down binary counter	$1.52
74194	4 bit right left shift register	$2.20
74196	4 bit parallel in shift register	$1.40
74197	40MHz decade counter	$1.64
74198	40MHz binary counter	$1.60
74199	8 bit shift register	$2.80
74221	Dual monostable schmitt input	$2.80
74248	BCD to 7 segment driver	$3.12
74249	BCD to 7 segment driver	$3.96
74251	Tristate 8 line to 1 line multiplex	$3.96
74257	Tristate quad 2 line to 4 line	$2.12
74265	Quad complementary output gates	$3.12
74279	Quad RS latches	$2.16
74283	4 bit full adder with fast carry	$1.40
74298	Quad 2-input multiplex with store	$2.64
74365	Hex tristate driver	$3.96
74366	Hex tristate inverter driver	$1.64
74367	2 + 4 tristate driver	$1.64
74368	2 + 4 tristate inverter driver	$1.64
74390	Dual decade counter	$1.64
74393	Dual binary counter	$3.12
		$3.12

CMOS-4000

4000	Dual 3-input nor plus inverter	32c
4001	Quad 2-input nor	32c
4002	Dual 4-input nor	32c
4006	18 stage shift register	$1.92
4007	Dual pair plus inverter	32c
4008	4 bit full adder	$1.96
4009	Hex inverter buffer	92c
4010	Hex buffer	96c
4011	Quad 2-input nand	32c
4012	Dual 4-input nand	32c
4013	Dual D flip flop	72c
4014	8 stage shift register	$1.96
4015	Dual 4 stage shift register	$1.64
4016	Quad bilateral switch	72c
4017	Decade counter	$1.64
4018	Divide by 'N' counter	$1.84
4019	Quad and or select	60c
4020	14 stage binary counter	$2.56
4021	8 stage shift register	$2.24
4022	Divide by 8 counter	$1.56
4023	Triple 3-input nand	32c
4024	7 stage binary counter	$1.12
4025	Triple 3-input nor	32c
4026	Decade counter	$3.64
4027	Dual JK Master slave flip flop	92c
4028	BCD to decimal decoder	$1.48
4029	Up down counter	$1.84
4030	Quad exclusive or	40c
4033	Decade counter	$3.76
4035	4 stage parallel shift register	$2.48
4040	12 stage binary counter	$2.48
4041	Quad true complement buffer	$1.76
4042	Quad D latch	$1.48
4043	Quad three state nor RS latch	$1.24
4044	Quad three state nand RS latch	$1.24
4046	Phase locked loop	$2.76
4049	Hex inverter buffer	84c
4050	Hex buffer	84c
4051	8 channel multiplexer	$1.56
4052	Differential 4 channel multiplexer	$2.24
4053	Triple 2 channel multiplexer	$2.24
4055	BCD to 7 segment driver	$3.36
4056	BCD to 7 segment driver	$2.48
4058	14 stage binary counter plus oscillator	$2.24
4060		$2.24
4066	Quad bilateral switch	$1.20
4068	Single 8-input nand	44c
4069	Hex inverter	44c
4070	Quad exclusive or	44c
4071	Quad 2-input or	32c
4072	Dual 4-input or	44c
4073	Triple 3-input and	44c
4075	Triple 3-input or	44c
4076	Three state quad D flip flop	$1.72
4077	Quad exclusive nor	48c
4078	Single 8-input nor	44c
4081	Quad 2-input and	32c
4082	Dual 4-input and	44c
4085	1 + 3 + 1 + 2 and or invert	$1.88
4086	4 + 4 and or invert expand	$1.88
4093	Quad 2-input nand schmitt	$1.40
4416	DPDT switch	$1.32
4426	Decade counter 7 segment driver	$3.76
4449	Economy hex inverter	44c
4502	Strobed hex inverter buffer	$1.96
4507	Quad exclusive or	$1.20
4510	Up down decade counter	$2.76
4511	BCD to 7 segment latch driver	$2.32
4512	8 channel data selector	$1.48
4516	Up down binary counter	$2.00
4518	Dual decade counter	$2.00
4519	4 bit and or select	$2.29
4520	Dual binary counter	$2.00
4527	Decade rate multiplier	$3.20
4528	Dual monostable multivibrator	$1.52
4531	12 bit parity tree	$3.12
4539	Dual 4 channel data selector	$3.00
4555	Dual binary to 1 of 4 decoder	$2.20
4556	Dual binary to 1 Of 4 decoder	$2.20
4553	Three digit BCD counter	$7.75

CMOS-74C

74C00	Quad 2-input nand	44c
74C02	Quad 2-input nor	44c
74C04	Hex inverter	44c
74C08	Quad 2-input and	44c
74C10	Triple 3-input nand	44c
74C14	Hex inverter schmitt	$2.16
74C20	Dual 4-input nand	72c
74C30	Single 8-input nand	72c
74C48	BCD to 7 segment decoder	$3.32
74C73	Dual JK flip flop	$1.12
74C74	Dual D flip flop	$1.12
74C75	4 bit latch	$1.12
74C76	Dual JK flip flop	$2.36
74C85	4 bit magnitude comparator	$2.96
74C90	Decade counter	$2.36
74C93	4 bit binary counter	$2.36
74C107	Dual JK flip flop	$2.84
74C160	Decade counter asynchronous clear	$3.12
74C161	Binary counter asynchronous clear	$3.12
74C162	Decade counter synchronous clear	$3.12
74C163	Binary counter synchronous clear	$3.12
74C174	Hex D flip flop	$3.12
74C175	Quad D flip flop	$2.60
74C192	Up down decade counter	$3.12
74C193	Up down binary counter	$3.12
74C194	4 bit right left shift register	$3.12
74C195	4 bit register parallel in	$3.12
74C221	Dual monostable multivibrator	$2.35

TTL-low schottky

74LS00	Quad 2-input nand	45c
74LS01	Quad 2-input nand (Open collector)	45c
74LS02	Quad 2-input nor	45c
74LS03	Quad 2-input nand (Open collector)	45c
74LS04	Hex inverter	45c
74LS05	Hex inverter (Open collector)	45c
74LS08	Quad 2-input and	45c
74LS09	Quad 2-input and (Open collector)	45c
74LS10	Triple 3-input nand	45c
74LS11	Triple 3-input and	45c
74LS12	Triple 3-input nand (Open collector)	45c
74LS13	Dual 4 input nand schmitt	$1.75
74LS14	Hex inverter schmitt	$2.35
74LS15	Triple 3-input and (Open collector)	64c
74LS20	Dual 4-input nand	45c
74LS21	Dual 4-input and	45c
74LS22	Dual 4-input nand (Open collector)	64c
74LS26	Quad 2-input nand driver 15V	96c
74LS27	Triple 3-input nor	52c
74LS28	Quad 2-input nor buffer	52c
74LS30	Single 8-input nand	45c
74LS32	Quad 2-input or	52c
74LS33	Quad 2-input nor (Open collector)	96c
74LS37	Quad 2-input nand buffer	52c
74LS38	Quad 2-input nor buffer	52c
74LS40	Dual 4-input nand buffer	52c
74LS42	BCD to decimal decoder	$1.85
74LS47	BCD to 7 segment driver 15V	$2.75
74LS48	BCD to 7 segment driver	$2.75
74LS49	BCD to 7 segment (Open collector)	$2.75
74LS51	3 + 3 and or 2 + 2 and or invert	64c
74LS54	2 + 3 + 1 + 2 and or invert	64c
74LS55	4 + 4 and or invert	64c
74LS73	Dual JK edge trigger flip flop	60c
74LS74	Dual D edge trigger flip flop	64c
74LS75	4 bit latch	$1.00
74LS76	Dual JK edge trigger flip flop	$1.24
74LS78	Dual JK edge trigger flip flop	65c
74LS83	4 bit binary full adder	$3.72
74LS85	4 bit magnitude comparator	$2.64
74LS86	Quad 2-input exclusive or	72c
74LS90	Decade counter	$1.64
74LS91	8 bit shift register	$2.84
74LS92	Divide by 12 counter	$1.64
74LS93	4 bit binary counter	$1.64
74LS95	4 bit right left shift register	$3.96
74LS107	Dual JK edge trigger flip flop	$1.24
74LS109	Dual JK edge trigger flip flop	76c
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This is the three I.C, SQ decoder kit as featured in EA February 1977. Complete with board, rotary pots and IC's. No case or power supply. This is a very popular kit. See below for conversion kit.

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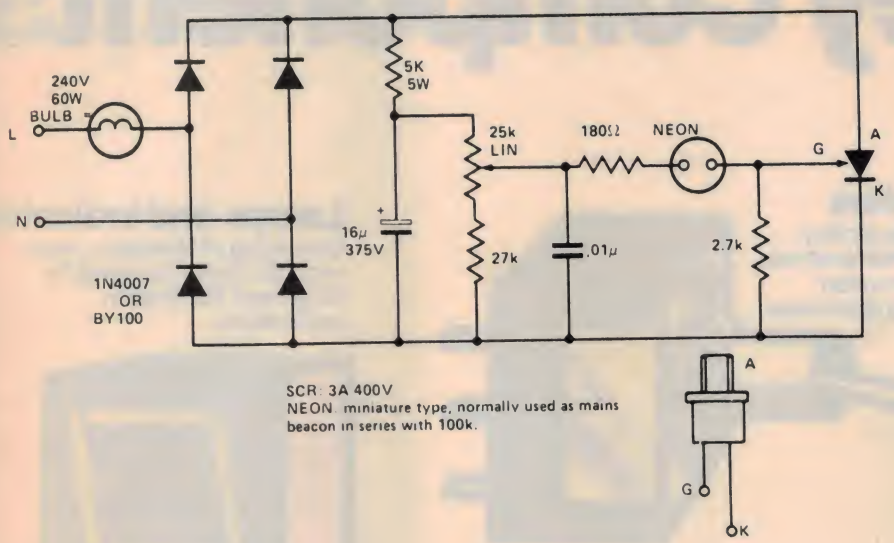
Ideas for experimenters



LOW FREQUENCY STROBE

The circuit will flash the bulb at a rate between 0 and 10 Hz. Points to note are:

(i) Because all components are connected directly to the mains, do not touch whilst the unit is on.

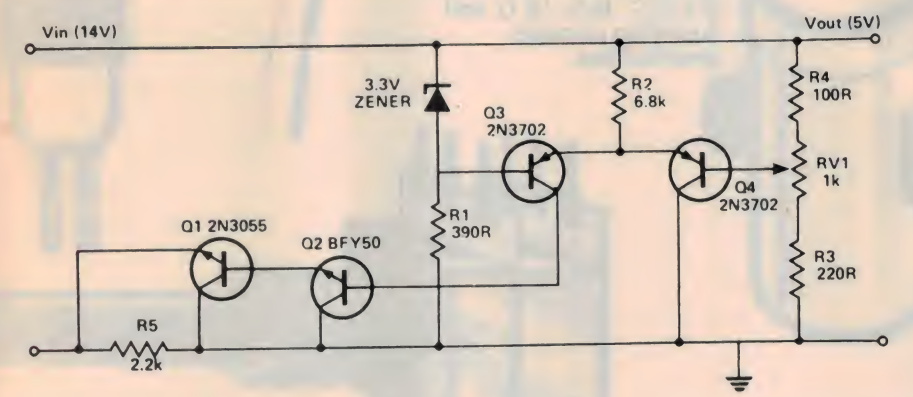
(ii) Use a television type 25 k pot with insulated spindle.

(iii) Mount in an insulated box with ventilation holes.

(iv) The 5 k resistor gets hot, hence the wattage rating.

(v) The 27 k may be altered to obtain a full range of control by the pot.

There is a risk of inducing convulsive seizures in people suffering from epilepsy if this unit is operated in their presence. Such people should avoid areas where strobe lights are used. A rate of nine flashes per second is considered the most dangerous and most people will find this unpleasant.

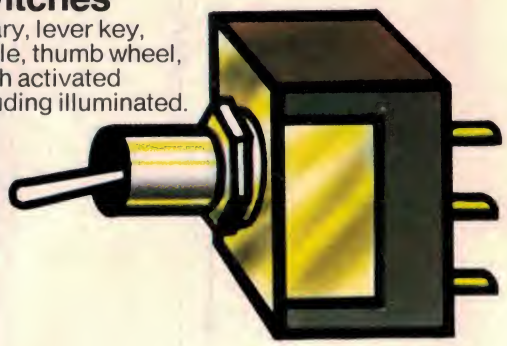


VOLTAGE REGULATOR AND ELECTRONIC FUSE

This circuit offers several useful features compared to more basic designs. Among them are the facts that current cut-off is achieved, it is self-resetting once that overload is removed and it is an efficient voltage regulator. Choose Z to be about 2/3 V_{out} and R_1 to supply enough current for stabilization of the Zener voltage. Choose R_2, which determines the cut-off current, I_{max} such that $I_{max}R_2 = (V_Z - 0.5) \times (\beta Q1 + Q2)$ and the values of R_3, RV_1 and R_4 so that the base of Q4 is at the same voltage as the base of Q3 and a large current (100 times) passes down the resistor chain compared to the base current of Q4 which is $(V_Z - 0.5)/R_2\beta Q4$. Altering RV1 gives fine control over V_{out}. R5 (200 ohms to 2.2 k) allows switch-on under no load conditions. Component values are given for a 5 V supply with a 2A cut-out. For low current applications, Q1 can be a BFY50 with Q2 omitted.

Plessey components.

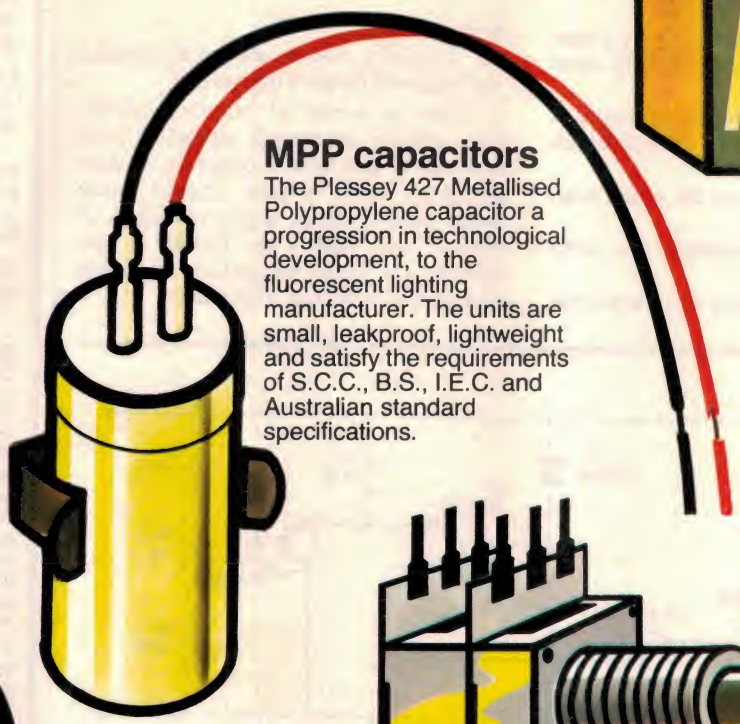
Switches
Rotary, lever key, toggle, thumb wheel, touch activated including illuminated.



Lamps and indicators
Consisting of filamentry, neon and LED styles designed for all general illumination applications.

Speakers – Foster
Speakers ranging from guitar, woofers, mid range, tweeters, horns, full range and elliptical, all are available.

MPP capacitors
The Plessey 427 Metallised Polypropylene capacitor a progression in technological development, to the fluorescent lighting manufacturer. The units are small, leakproof, lightweight and satisfy the requirements of S.C.C., B.S., I.E.C. and Australian standard specifications.



Sonalerts – Mallory
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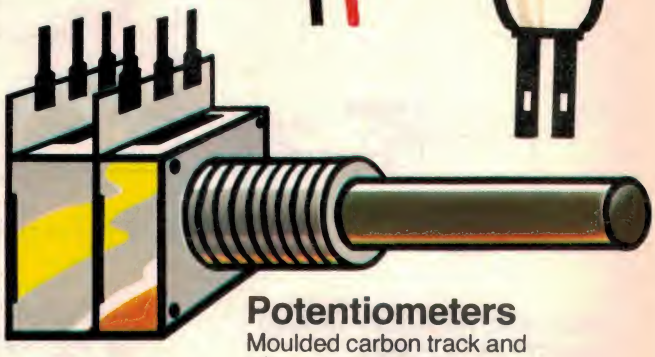
Optoelectronic devices
Including LDR's, LED's photodiodes, phototransistors, photocouplers and 7 segment, alphanumeric and cold cathode displays.



Potentiometers
Moulded carbon track and wire-wound of both commercial and professional standard.

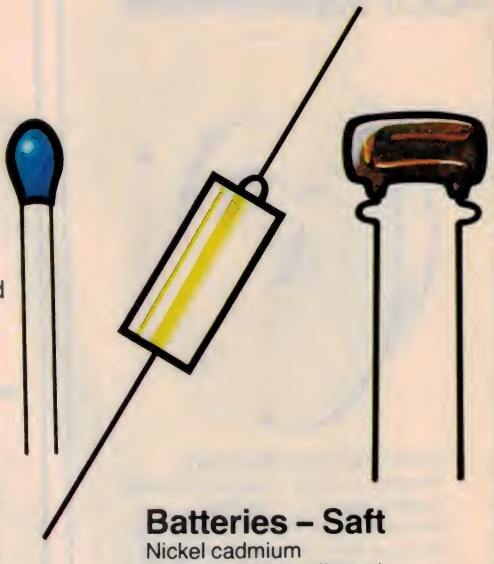
The complete range.

"E" Cell

The "E" Cell device suitable for a number of applications such as repetitive timing and control, pulse counting and memory, timing, current-time integration, use-time measurement.

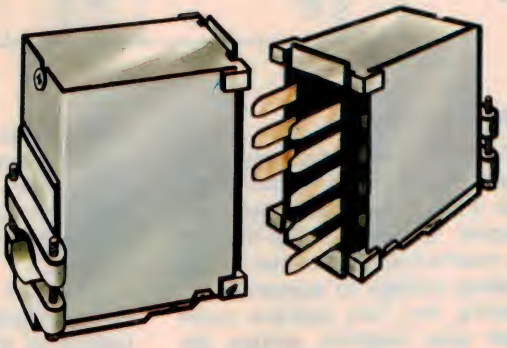
Capacitors and resistors

Capacitors for a wide variety of applications, ranging from tantalum, electrolytic, chip ceramic, variable ceramic, precision piston trimmers. And resistors metal glazed 1/16 Watt, 30 to 1000M.



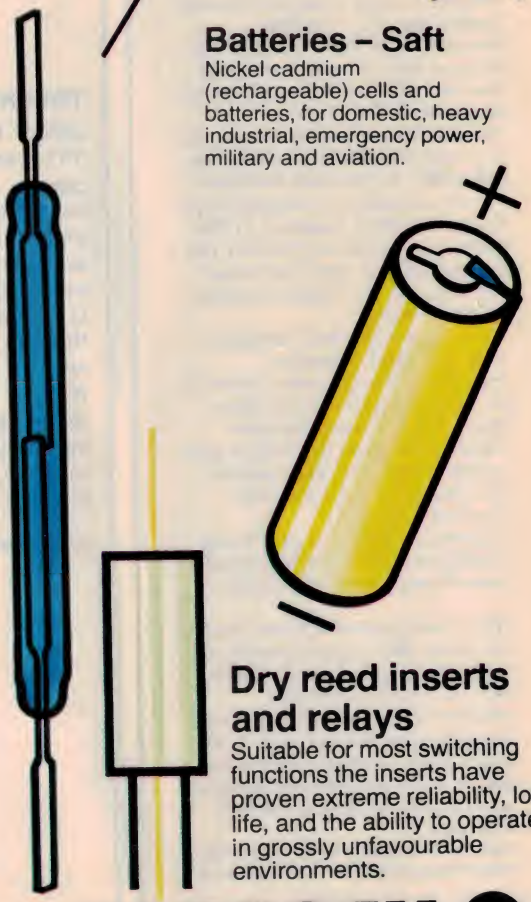
Batteries – Saft

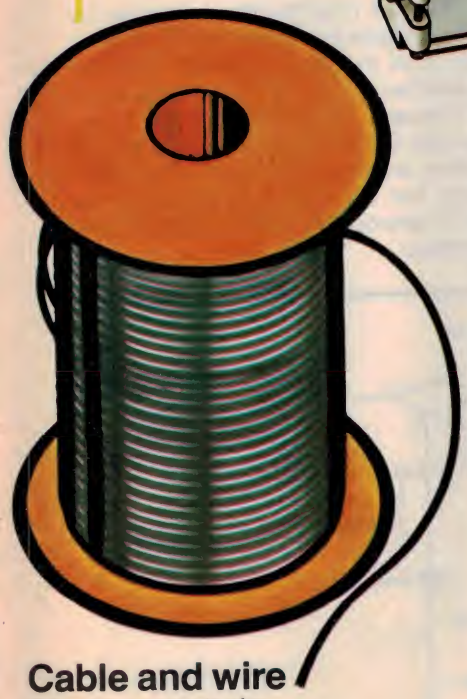
Nickel cadmium (rechargeable) cells and batteries, for domestic, heavy industrial, emergency power, military and aviation.



Connectors

A multitude of connectors including the Multicon range consisting of 2, 4, 6, 8, 10, 12, 18, 24 and 33 pole. Also the 159 range of plugs and sockets ranging from 7 to 71 poles. Gold flash on contacts and solder tags for long term protection against tarnishing.



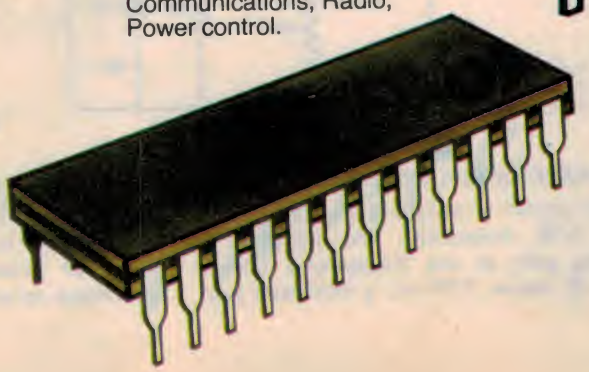


Dry reed inserts and relays

Suitable for most switching functions the inserts have proven extreme reliability, long life, and the ability to operate in grossly unfavourable environments.

Semiconductors

Digital and linear devices using MOS technology for Communications, Radio, Power control.



Cable and wire

OKI cable and wire for electronic applications ranging from switchboard cable, various plastic insulated wire to high frequency coaxial cable.

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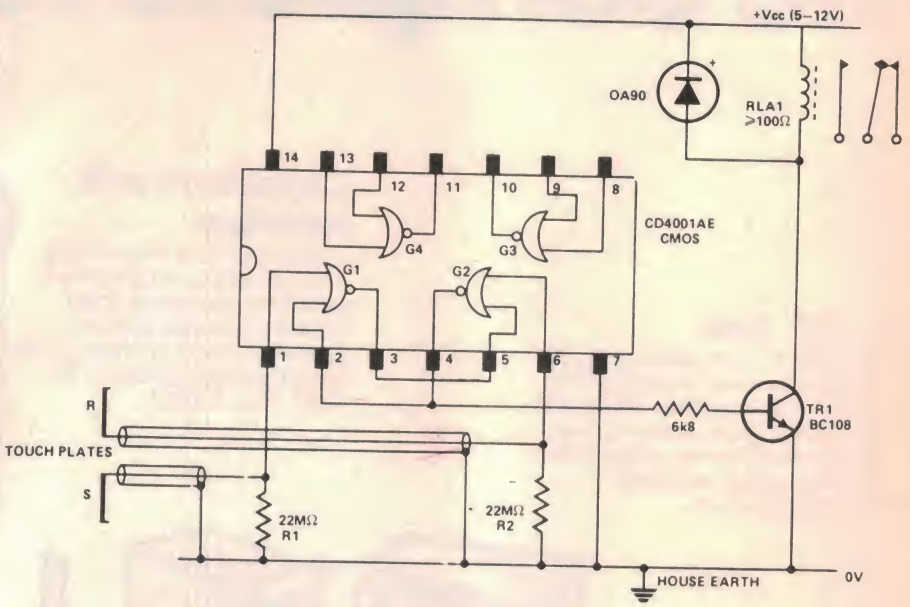
SA: K.D. Fisher, Prospect 2692544. **WA:** H.J. McQuillan, Welshpool 687111.

AC86

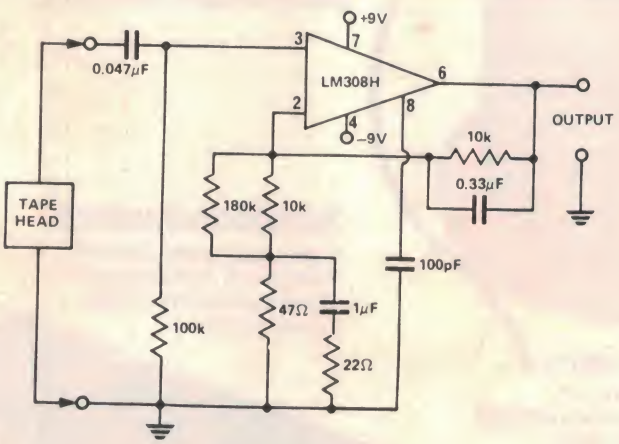
Ideas for experimenters



TOUCH FLIP FLOP

CMOS IC.s have many advantages over TTL, one being the high input impedances. In Fig. 1, two NOR gates are cross coupled to form a flip-flop. If plate S is touched ambient noise causes an alternating voltage to appear at G1 input. During the first positive cycle G1 output goes negative setting the flip-flop and turning RLA1 on. It remains on until the R plate is touched. R1 and R2 must not be omitted since they discharge any potentials remaining on the plates after they have been touched, thus allowing the flip-flop to have its state changed rapidly. R1 and R2 also prevent any static charges building up, thus damaging the IC, while the supply is disconnected. 22M ohm resistors are difficult to get so two 10M ohm resistors in series may be used.

The unit may be left on continually as a milliameter indicates no current flow at all in the off position. If RLA1 is omitted TR1 collector becomes a TTL output with a high fan out. Connect the inputs of G3 and G4 to ground if they are not to be used. The touch plates can be placed several feet from the IC provided screened cable is used for them.



IC TAPE-HEAD PRE-AMP

This circuit is suitable for a tape speed of 3.75 inches/sec. and provides a rising gain at low frequencies (about 40 dB below 100 Hz) a minimum gain of about 15 dB around 2-3 kHz and a 6 dB boost (to about 21 dB) above 10 kHz for reasonable compensation. A low noise op-amp is used.

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Please Explain

TV/FM Antenna

Is it possible to operate an FM tuner and a TV set from one and the same antenna? Can I just connect the FM antenna input to the antenna socket on my TV?
C.D. Fitzroy, Vic.

1. Yes. 2. No! It is possible to design a dual purpose antenna. ETI is doing this right now in fact and we'll publish details soon. But it's not feasible to connect your TV and FM tuner to the existing antenna without prejudicing the performance of both devices.

WHITE NOISE

What is 'white noise'?
G.K. Darwin, N.T.

It's a wide spectrum of noise in which the energy distribution is constant per cycle. A good example of 'fairly white' noise is heard between stations on an FM radio.

For some purposes white noise is converted to pink noise. Pink noise is derived by filtering white noise so that the sound energy per octave is constant. Both types of noise are used by speaker engineers for assessing the results of their labours.

If you try this yourself don't turn the volume up too high—remember that there's a lot of energy going into the tweeters.

Optimising Listening Rooms

I'm about to build a new house in which I'm planning a music room. This room will be used a fair bit for listening to hi-fi. Are there any general rules about room shapes, etc. that I should follow—or can you direct me to a source of information.
B.N. St. Ives, NSW

You should try to reduce resonances produced by parallel walls. The very worst shape would thus be a cube with hard reflective surfaces.

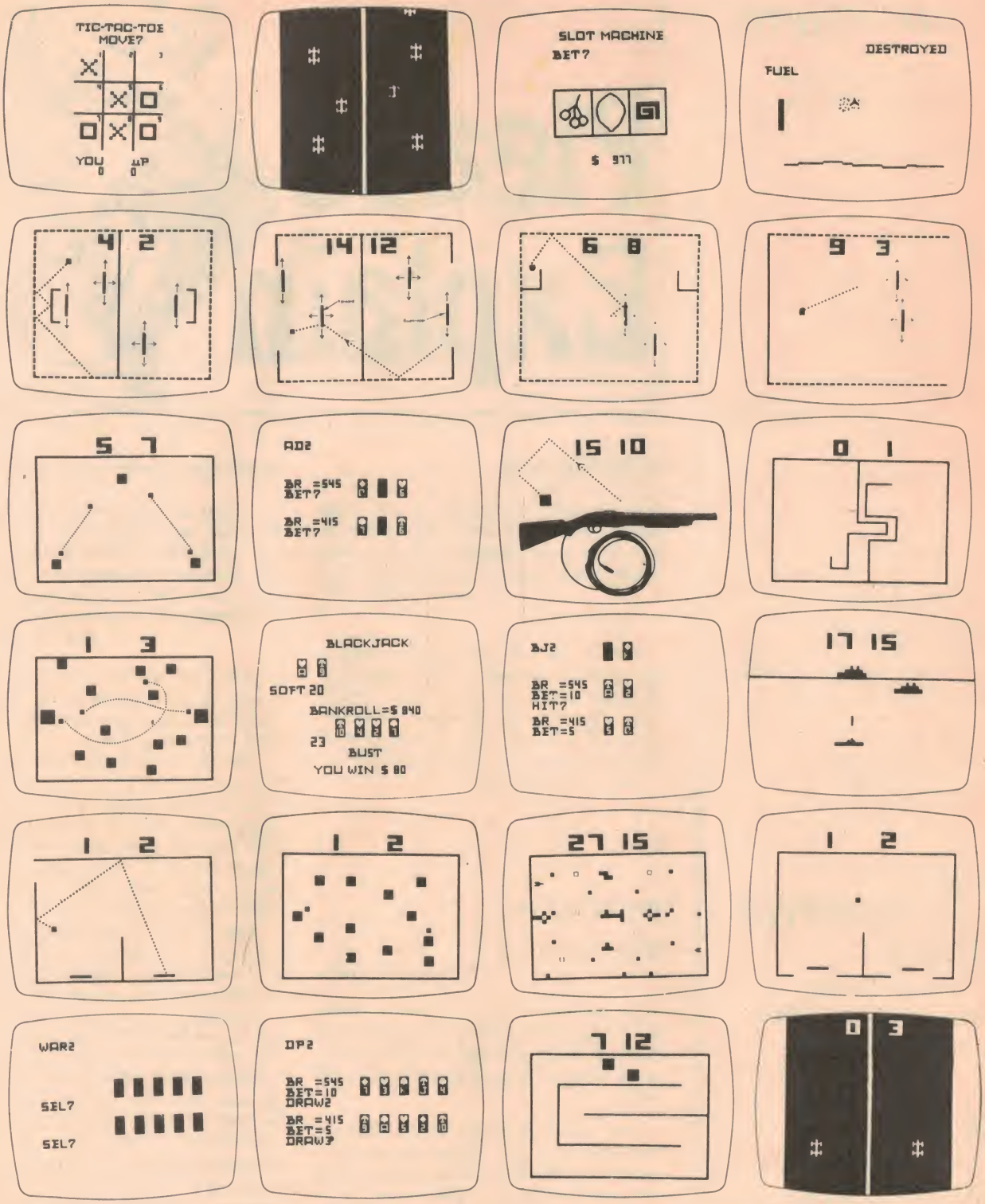
The best practicable dimensions follow the Golden Ratio—that is ratios of 1:1.6:2.5 for height, width and length respectively. Thus if the ceiling height is 8'6" the width should be 13'6" and the length about 21'. You could make the room smaller than that but bass reproduction would suffer.

Ideally you could have the ceiling sloping in one direction or the other—or have one wall angled slightly. Both techniques would reduce reflections but you would have a slightly freakish house that could be harder to re-sell.

The wall *behind* the speakers should be reflective but it often pays to have some acoustic damping material on the wall *furthest* from the speakers. A woollen wall hanging is ideal.

A chapter dealing with room acoustics is included in the Electronics Today International publication 'Hi-Fi Explained'. This book was first published in 1974 but a completely revised version has just been produced and will be available at most newsagents by the time this issue of ETI is on sale. (The book may also be obtained directly from ETI for $3.40 including postage and packing).

ADVANCED VIDEO GAME IC'S



In May 1967 we introduced the first Video Game IC into Australia (see our Catalog No 7). Today we are announcing a complete new Series of advanced Video Game IC's. Play Tank Battles, fire guns, hear engine, gun fire, shell burst and tank explosions, drive through minefields and other battlefield barriers. Or play with Satellites and Missiles, if tired switch to a Submarine Game, torpedo ships, fire depth charges, hear explosive sounds etc.. If you are a racing fan switch to Roadrace and test your driving skill and reaction time. For Gamblers there are many card games with up to 500,000 different plays. Play Black Jack, Draw Poker, Acey/Deucy or War, each card game can be played with one or two players. Or play with your own Slot Machine and win the Jack Pot 200 for 1, play Black Jack to Las Vegas Rules with four decks (208 cards). There are many more Games to choose from. Some have controls for 4 players, color timing circuitry is incorporated in most IC's. To get you started we suggest that you obtain our 78 page catalog on "VIDEO GAME IC's and CIRCUITS", Price $6.50 plus $0.50 postage. This catalog is full of Circuits for Rifles, how to modify the old AY-3-8500 IC for four players, how to add color, and how to obtain black and white bats for your black & white TV, select random ball speed and random angles etc.. With this catalog you receive a $3.00 Voucher which can be used towards the purchase of Video Game IC's. Should you live near to us and have an interest in electronics we might have work for you in our air-conditioned workshop assembling and testing TV Games. Write us for more details. Dealers wanted in all states for distribution of TV Games .

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THE COBRA 26 $129

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If anyone is giving away an old television (any condition), please contact K. Rayner, Box 127, Richmond 2753. Transport available in West Sydney suburbs.

CRT, 3in. "Cintel Cathavisor" type C510-C6 ser. no. 377, 18kV anode, 4V heater. $30 in crate, unused. P. Dawson, Ph (AH) (03) 3932105.

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MELBOURNE tape friends, THE RECORDING SOCIETY OF AUSTRALIA meets monthly for lectures and demonstrations. For further information and syllabus ring (AH) (03) 459-1717 or (03) 99-4185

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Wanted Nov — Jan (76-77) editions of Everyday Electronics or good photocopies of Doing it Digitally parts 2,3,4. Contact Darrell Berry, Exeter West Tamar Tas.7251.

SELL SB101 Heathkit SSB transceiver, not working. Powersupply, Speakerbox, Transceiver cabinet etc, very good condition, Transceiver needs attention $150 the lot. Phone BERT 425312 AH 7584086.

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1 THE RESEARCH — More than twenty years ago, Maxell produced their first reel of magnetic tape. At that time, Maxell made a commitment to produce and sell only the finest magnetic products their technology could create.
That commitment still stands today.

2 THE TAPE — This continuous research has lead to the development of the Maxell UD (ultra dynamic) cassette. A tape that has a coating of super-fine PX gamma ferric oxide particles with an extra smooth mirror-finish surface.
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3 THE SHELL — Even the best tape can get mangled in a poorly constructed shell. That's why Maxell protects its tape with a precisely constructed shell, made of lasting heavy-duty plastic.
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ULTRA-DYNAMIC UD

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a) Non-abrasive head cleaning leader (cleans recording head for 5 secs.).
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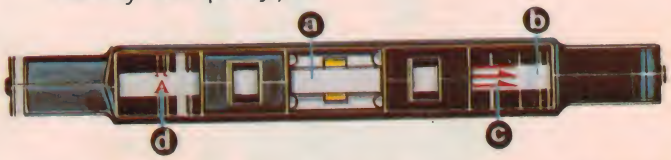

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